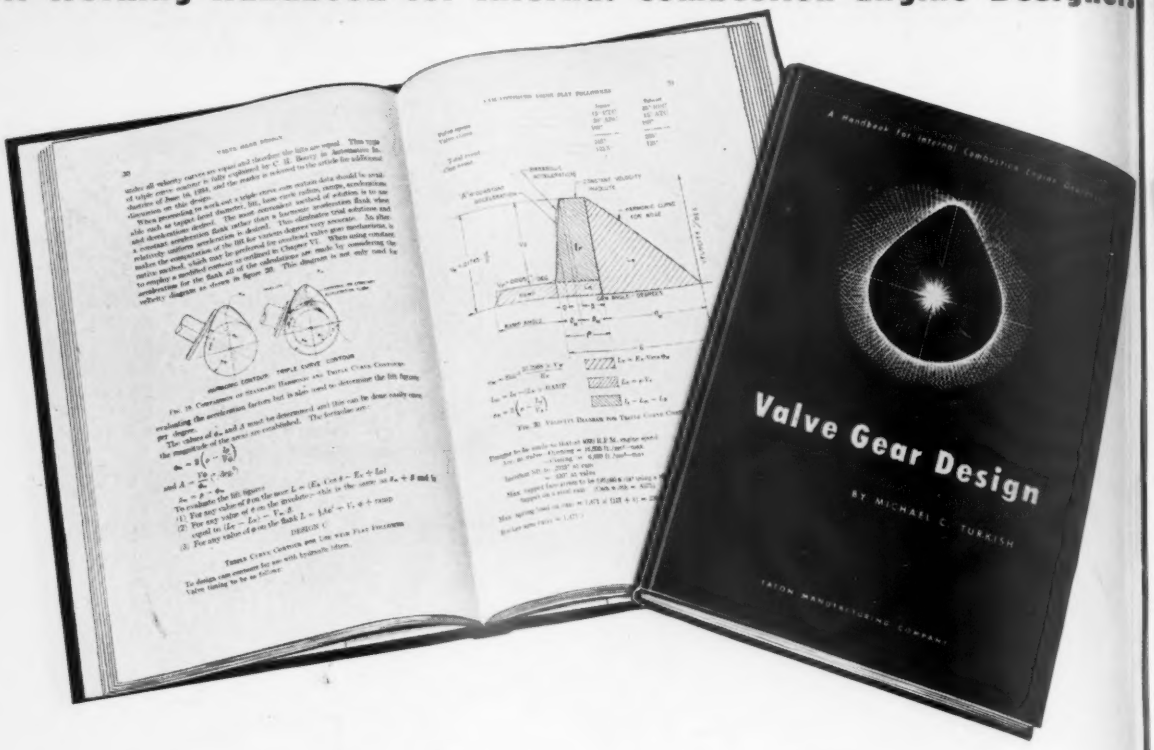
AERONAUTICAL ENGINEERING REVIEW

INSTITUTE OF THE AERONAUTICAL SCIENCES

MAY 1947

INDIANA UNIVERSITY LIBRARY JUN 4

A Working Handbook for Internal Combustion Engine Designers



"Valve Gear Design"

by Michael C. Turkish

At Book Stores in Industrial Centers or Direct from Eaton Manufacturing Co.
Cloth Bound, Gold Stamped.
Size 7 x 10½ $6.00

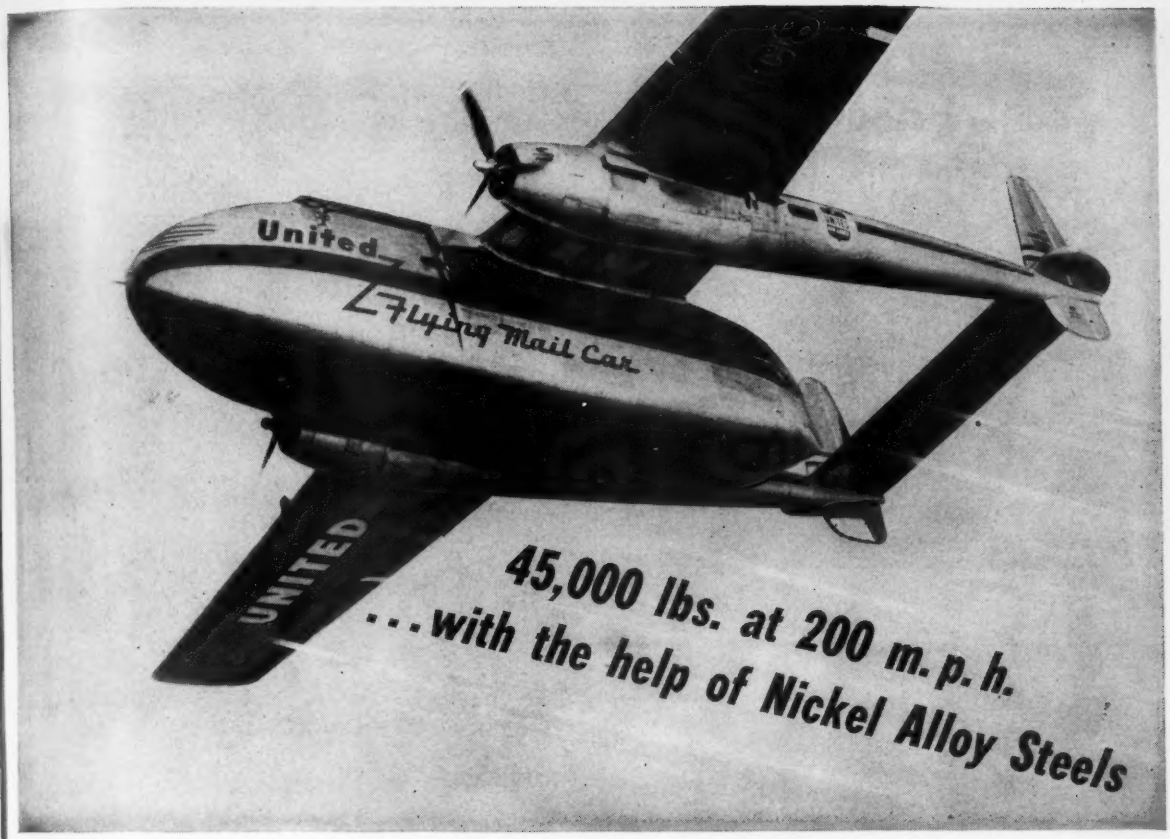
"Valve Gear Design" by Michael C. Turkish is the first comprehensive treatise on the designing of cams, tappets, valve springs, and other valve gear units for internal combustion engines. It is replete with diagrams and formulae which will be invaluable both to the student and the designing engineer.

In its 130 pages, "Valve Gear Design" combines theory and mathematics with actual experience in connection with leading automotive and aircraft engine designs. It is written by a man who is eminently qualified to write authoritatively on this highly specialized phase of automotive engineering.

ABOUT THE AUTHOR

As cam design engineer and mathematician for Eaton Manufacturing Company, Michael C. Turkish has played an important part in the development of cam design procedures, both from a theoretical and practical standpoint. The discussions and recommendations in this book are based upon years of actual experience with all types of internal combustion engines—automotive, aircraft, marine, and industrial.

EATON
MANUFACTURING COMPANY
9771 French Road • Detroit 13, Michigan



This "Flying Mail Car" with its 2916 cubic feet of cargo space shows the far-reaching advantages of using Nickel alloy steels in aircraft.

Firewalls and exhaust stacks along with ducts, shafts, bushings and valves of its heating system, are all made of stainless chromium-Nickel steels, to provide resistance to corrosion and high temperature effects. Swaged fittings on all control cable assemblies are also fabricated from stainless steel.

AIR MAIL GETS FASTER SERVICE THAN EVER! Now, for the first time, air mail can be sorted in the air. A 38-foot interior compartment provides ample space for mail clerks and equipment. The "Flying Mail Car" (Army C-82 Packet) is made by Fairchild Aircraft Division of Fairchild Engine & Airplane Corp.

Nickel alloy steels of the 8630 and 8740 types are specified for the big landing gear, the nacelle structures, engine mounts and pilot's control pedestal. In addition to providing ample strength, these steels show superior behavior in fabrication.

Pipe fittings, nuts, rivets in exhaust wells, and many other metal parts are also specified in Nickel alloyed steels to assure maximum flying safety.

And, following standard practice in aircraft engine design, Nickel alloy steels are used for highly stressed parts throughout the two Pratt & Whitney engines, as well as in the Hamilton Standard hydromatic propeller hubs, with which this plane is equipped.

Wherever you need high mechanical properties and low weight combined, you can find a Nickel alloy steel especially suited for the specific job.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

Summer overcoats for airplanes cut maintenance costs

THE SUMMER SUN used to make it hot for De-Icers. Its burning rays aged the rubber and promoted deterioration. So De-Icers had to be removed from planes, wrapped and stored each summer. To eliminate this seasonal maintenance, B. F. Goodrich engineers searched for a protective coat which would enable planes to wear their De-Icers all year 'round.

They found the answer in B. F. Goodrich Summer Film. This tough, reflective "overcoat" seals the De-Icers from the damaging rays of the sun all summer long. And it completely eliminates the man-hours spent in removing and reinstalling De-Icers.

Summer Film cuts maintenance costs in other ways, too. It protects De-Icers from the erosive effects of sand, wind, rain and dirt. It prevents possible injuries to De-Icers during twice-a-year handling. And it prolongs De-Icer life.

In addition, all the advantages of year 'round De-Icer protection are made possible by Summer Film. Its light weight, thinness and tough elasticity permit normal De-Icer operation in case of unseasonal icing conditions. And the De-Icers add extra safety by protecting leading edges against summer hail storms.

Summer Film is economical and simple to use . . . a one-man operation, as shown above. The mechanic just wipes the De-Icer clean, masks it off with paper and sprays on quick-drying Summer Film like paint. At the end of the summer, he simply peels off the one-piece film . . . and the De-Icer is ready for another season's service. That's how B. F. Goodrich Summer Film makes possible maximum De-Icer life with a minimum of servicing. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

B.F.Goodrich

FIRST IN RUBBER

Cover—The Martin Two-0-Two, designed as a practical, economical air-line transport, completes prelicensing flight tests.

Editor
Welman A. Shrader

Technical Advisers
Hugh L. Dryden
Robert R. Dexter
S. Paul Johnston

Associate Editor
Bemeice H. Jarck

Reviews, Managing Editor
Harris F. Reeve

News Editor
John F. Mason

Reviews, Technical Editor
Edward G. Ingram

Assistant Editor
Lillian E. Bermont

Acting Manager
Austin G. Cragg

Manager, Western Region
James L. Straight
6715 Hollywood Blvd., Los Angeles 28, Calif.

ABC

SUBSCRIPTION RATES

Aeronautical Engineering Review: United States and possessions, 1 year, $3.00; single copies $0.30. Foreign countries including Canada (American Currency Rates), 1 year, $3.50; single copies, $0.35.

Entered as second-class matter at the Post Office, Easton, Pa., April 29, 1942. Acceptance for mailing at a Special Rate of Postage as provided for in the Act of August 24, 1912.

Publication Office: 20th & Northampton Streets, Easton, Pa.

Editorial Office: 2 East 64th Street, New York 21, N.Y.

Notices of change of address should be sent to the Institute at least 30 days prior to actual change of address.

Statements and opinions expressed in the *Aeronautical Engineering Review* are to be understood as individual expressions and not those of the Institute.

Copyright, 1947, by the Institute of the Aeronautical Sciences, Inc.

AERONAUTICAL ENGINEERING REVIEW

Vol. 6 May, 1947 No. 5

Contents

I.A.S. News 5
Editorial 21

Articles

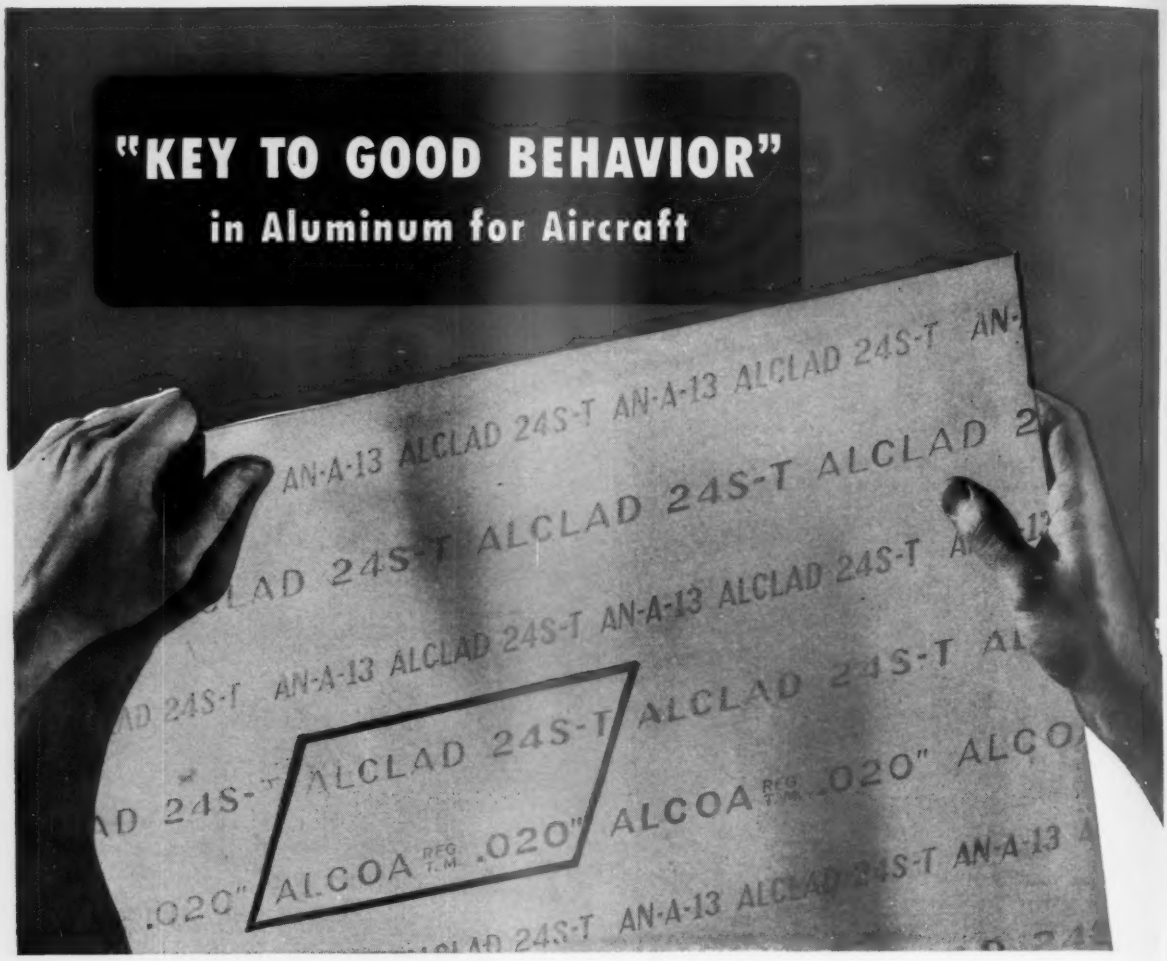
Cleveland Confab 22
I.A.S. Briefs 26

Reviews

Aeronautical Reviews 29
Books 59

Personnel Opportunities 63
Appreciation to Corporate Members 72
I.A.S. Meeting Preprints 73
Index to Advertisers 75

Published Monthly by the Institute of the Aeronautical Sciences, Inc.



The Alcoa name on an aluminum alloy means that you can know, in advance, far more about its behavior than is possible with many other materials. Because Alcoa Research and Quality Control have tested it thoroughly, established its many physical properties in great detail and to a high standard of accuracy.

Hundreds of thousands of such tests are run every year at Alcoa. Routine tests for tensile strength, yield and elongation. And in addition, many other tests *not called for* by aeronautical specifications, that provide *extra* knowledge of properties.

When you specify Alcoa Aluminum you know more about what you're getting. This is another *Alcoa plus*, one of many that have made Alcoa Aluminum important in aircraft since the days of Kitty Hawk. ALUMINUM COMPANY OF AMERICA, 2142 Gulf Bldg., Pittsburgh 19, Pa. Sales offices in principal cities.

MORE people want MORE aluminum for MORE uses than ever

ALCOA FIRST IN **ALUMINUM**

IN EVERY COMMERCIAL FORM

I.A.S. News

A Record of People and Events of Interest to Institute Members

Personal Aircraft Meeting Program Takes Shape

William T. Piper, L. Welch Pogue, and C. J. Reese to Be Guest Speakers at Dinner and Luncheons.

IMPORTANT ADDITIONS to the Fourth Annual Personal Aircraft Meeting program, as well as several last-minute changes in schedule, have now been completed. The finished picture promises to provide a thorough analysis of the personal plane industry from the pilot's, designer's, engineer's, private owner's, and scientific and research specialist's points of view. All events are to be held in the Horace H. Rackham Educational Memorial of the Engineering Society of Detroit, May 26–27.

William T. Piper, President of Piper Aircraft Corporation, will be the principal speaker at the Annual Dinner on May 26 at 7:30 p.m. He has selected "A Manufacturer Looks Ahead," as his topic. L. Welch Pogue, President of the N.A.A., will talk on "Organized Community Action; the Key to Aviation Progress."

A luncheon will be held each day at 12:30 p.m. C. J. Reese, President of Continental Motors, Inc., has been named guest speaker on Tuesday, and an informal Get-Together Luncheon is scheduled for Monday.

Eugene W. Norris, Vice-President of Luscombe Corporation in Charge of Engineering, has accepted the Chairmanship for the first technical session on May 26 at 10:00 a.m. Two papers are scheduled for this meeting: "Unified Design for Performance and Safety Characteristics," by Frederick Ross, University of Michigan, and "Factors Affecting the Design of Quiet Propellers," by A. A. Regier, Electrical Engineer, and H. H. Hubbard, Aeronautical Engineer, Physical Research Division, Langley Memorial Aeronautical Laboratory, N.A.C.A.

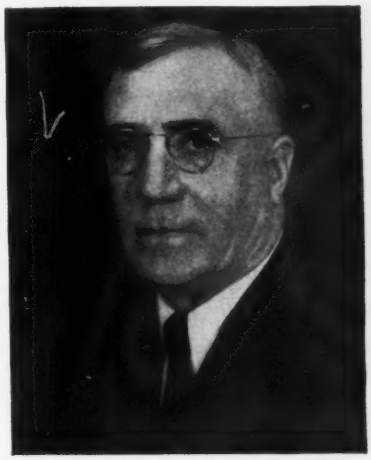
Following the Get-Together Luncheon, Monday, Chairman Robert Insley, Vice-President, Continental Motors, Inc., will open the 2:30-p.m. session. Otto Koppen, Massachusetts Institute of Technology, will present a paper on "Ejector Cooling and Muffling." "Installation Problems with Submerged Engines," will be given by W. R. Burrows, Chief Project Engineer, and Reginald I. Rice, Installation Engineer, of Aircooled Motors, Inc. A third paper, "A Review of Service Experience with Aircraft Power Plant Installations," is scheduled to be presented by D. L. Posner, Chief, Power Plant Installation Section, C.A.A.

On Tuesday morning at the Detroit City Airport, the C.A.A. will demonstrate landings using new cross-wind landing gears.

Papers scheduled for the Tuesday afternoon session are: "The Design Engineer's Role in Airplane Cost Reduction," by H. G. Erickson, Structural Design Engineer, Luscombe Airplane Corporation; "The Flying Automobile —a Study of the Problem," by Joseph M. Gwinn, Chief Engineer, Hoist and Body Division, Gar Wood Industries, Inc.; and "Preliminary Design Studies —Piper Skysedan," by Wallace J. Wilkie, Piper Aircraft Corporation.

A Symposium entitled "Can the Manufacturer Make What the User Wants?" will conclude the two-day conference. This meeting, sponsored jointly by the Institute and the Engineering Society of Detroit, with assistance by the Aircraft Owners and Pilots Association, is designed to bring forth the views of all phases of interest in private flying. The subjects of Performance, Safety, and Utility will be discussed by a panel consisting of pilots and engineers. The pilot's point of view will be presented by Col. Cass S. Hough, Alfred L. Wolf, and Leighton Collins. The engineers will be represented by Fred E. Weick, Jerome Lederer, and Raymond Hermes.

Ralph H. Upson, Professor of Aeronautical Engineering, University of Minnesota, has been appointed Chairman of the Symposium.



William T. Piper.

I.A.S. Calendar

May 26–27, 1947	Personal Aircraft Meeting,	Detroit, Mich.
August 7–8, 1947	Annual Summer Meeting,	Los Angeles, Calif.

Paul Hovgaard Joins Piasecki Helicopter Corporation

Paul E. Hovgaard, a Fellow of the Institute, has been appointed General Manager of the Piasecki Helicopter Corporation at Sharon Hill, Pa. He will be responsible for the management of the Engineering and Factory divisions, as well as the Inspection Department. F. N. Piasecki, President of the company, stated that this position was created to handle several Army and Navy helicopter contracts. Current projects include production of the large tandem transport HRP-1 helicopter and development and fabrication contracts for two other types of helicopters for military service.

Mr. Hovgaard comes to Piasecki with more than 20 years of experience with a number of the most prominent aeronautical companies in the country. He began his aviation career barnstorming soon after leaving Kansas State College and has continued to act as test pilot on many occasions.

He has been associated with the Travelair Airplane Company, Keystone Aircraft Company, Pennsylvania Syndicate, Kellett Aircraft Corporation, Pitcairn, Curtiss-Wright Corporation, and The Glenn L. Martin Company.

Prior to his present position he was Assistant Director of the Cornell Aeronautical Laboratory.

John W. Sharp Forms New Engineering Company

John W. Sharp, a Member of the Institute, has recently formed the Creative Engineering Company with offices in San Diego. Mr. Sharp was affiliated for 10 years with the Douglas Aircraft Company, Inc., as an Engineer. During the war he managed their London office, which was under contract to the Eighth Air Force.

As a pilot, in 1932, he operated both land- and seaplanes commercially. He has had experience as a Flight Test Engineer at both the Douglas and Boeing companies. For 15 years Mr. Sharp has specialized in engine-installation design, service, testing, and sales engineering.

Prior to forming his new company he was in charge of Production Engineering of the Consolidated Vultee 240 engine installation.

The Burden-Tissandier Collection

The family of Albert and Gaston Tissandier, whose achievements and writings have a secure place in the history of aeronautics, possessed an aeronautical collection of great distinction. A substantial part of this collection was purchased by W. A. M. Burden several years ago, and through his generosity many of these outstanding pieces have been loaned to the I.A.S. Aeronautical Museum and are on view there. This part of the museum has been designated as the Burden-Tissandier Collection.

Paul E. Hovgaard.

Among the 18th century French pieces are a chest of drawers with an intricately inlaid scene of the return of the Charles and Robert hydrogen balloon to the Place des Victoires in Paris after its successful ascension in 1783; a dressing case showing the balloon of Blanchard and Jeffries completing its crossing of the English Channel in 1785; a powder table inlaid with a scene of the first man-carrying balloon ascension of Pilâtre de Rozier and the Marquis d'Arlande in 1783; and four chairs with carved balloon backs of Zambeccari's balloon, which ascended at Bologne in 1784. The needlepoint seats of these chairs show four different historical balloon scenes. One of the outstanding examples of inlay work, in a secretary of the period, shows a Blanchard balloon of 1784 in alternating strips of green and yellow wood, following the original colorful design of the balloon.

The collection includes 18th century china, snuff boxes, miniatures, a balloon clock, sculptured calendars, a gilded frame mirror decorated with a balloon, and framed admission tickets to early balloon ascensions.

Mr. Burden's generosity to the I.A.S. in many ways is well known. Among his numerous gifts are included a substantial part of his library, which he originally loaned in 1940, and clipping files of great value.

Gifts to the Institute Collections

The Westinghouse Electric Corporation sent several hundred *N.A.C.A. Wartime Reports* through the courtesy of H. J. Clyman. Issues of 28 periodicals for 1946 and 1947 were sent by W. A. M. Burden. Issues of its publication, *Technique et Science Aéronautiques*, were received from L'Association des Anciens Élèves de l'École Nationale Supérieure de l'Aéronautique (L'Afita) through the courtesy of Jacques Cornillon.

Mrs. Bella C. Landauer added a balloon ashtray to her previous generous gifts. LeRoy V. Coburn added air labels and timetables to his previous gifts. A survey of the aviation equipment market was received from the Whiting Corporation through the courtesy of Evert C. Hokanson.

Additional gifts were received from Rear Adm. Luis de Florez; the Institute of British Foundrymen; Pacific Overseas Airlines; the Royal Aero Club of Belgium; The Royal Aeronautical Society; Slick Airways, Inc.; Southwest Airways Company; West Coast Airlines, Inc.; and the U.S. Air Matériel Command, Civil Aeronautics Administration, and the Navy Department, Bureau of Aeronautics.

News of Corporate Members

The Airborne Instruments Laboratory, Inc., at Mineola, N.Y., a subsidiary of Aeronautical Radio, Inc., has recently established a branch unit in Burbank, Calif. The new branch is completely equipped to make antenna impedance measurements and to determine the radiation patterns of aircraft antennas by using model aircraft. Its purpose is to establish a closer working alliance between the Mineola laboratory and the designers of new aircraft in West Coast plants.

The Laboratory, through Navy contracts, has been designing and developing faired-in, completely dragless antennas for high-speed planes. Since this work has now become a part of the primary contract for each new aircraft, A.I.L. has formed the new group in order to eliminate much of the delay entailed in cross-continental communication.

A.I.L. is closely allied with the Air Transport Association and the Armed Services in the development of radar and electronic devices to aid civil aviation. It is the peacetime successor to the group known by the same name which worked under Columbia University on O.S.R.D. and N.D.R.C. wartime projects. During that period it played an important part in the development of the Magnetic Airborne Detector (an anti-submarine device now being considered as a possible aid in the search for oil and

other geophysical exploration) and many radio-countermeasure equipments.

The installation of a Microwave Early Warning system near La Guardia Airport is an outgrowth of a demonstration made by the Laboratory last October. An important feature of this equipment is the absence of ground-return clutter from the oscilloscope screen. The Laboratory has also assisted materially in the installation of another such radar set at National Airport in Washington, D.C.

The B. F. Goodrich Company has formally opened a new factory in Troy, Ohio, to house their airplane wheel and brake division. The plant, which started operations last November, produces brakes and wheels for all sizes and types of planes—ranging from 5-lb. units for one-place planes to the 334-lb. wheel-and-brakes used on the Army's new B-50.

In 1946 Goodrich purchased the airplane wheel and brake division of Hayes Industries, Inc., and moved the equipment from the Jackson, Mich., plant to their new factory in Troy. New facilities have also been installed in a building that was formerly a Waco aircraft plant.

In addition to the home office in Akron, the Goodrich company now has a divisional headquarters—chemicals—in Cleveland and an experimental station at Avon Lake. Before the year's end the Goodrich company intends to open a plastics processing plant at Marietta and a Research Center at Brecksville.

Pan American World Airways System has received the Inter-American Safety Council Award for 1946. The award was made in recognition of a year's operation without flight accident or fatality to passenger or crew over any of their world-wide routes.

The Council, represented by its President, George H. White, formally presented the award to Pan American's president, Juan Trippe, at the System's executive office in New York.

In accepting the award Mr. Trippe paid tribute to the entire Pan American Airways System. He also referred to the 1946 safety record made by the air lines of the United States as a whole.

Receiving the award, Mr. Trippe said: "Safety has always been Pan American's principal objective. We are happy to receive this award as Pan American's contribution to safety in 1946—a year in which the whole United States air transport industry made a new safety record....."

Each year the Inter-American Safety Council makes awards to both United States and foreign air lines that complete a calendar year without a flight accident or fatality to passengers or crews.

All operating divisions of the Pan American Airways System received individual certificates.

Sections and Branches

Hagerstown Section

The March 12 meeting of the Section was devoted to a discussion of the papers delivered at the I.A.S. Fifteenth Annual Meeting in New York. The following members led the discussion: Roy W. Lessard, Dr. H. Serbin, Henry Sieradski, Logan Waterman, and D. W. Weller.

Philadelphia Section

By Seymour Gottlieb, *Secretary*

H. Russell Young, Section Vice-Chairman and Chief Engineer of Testing Machines, Baldwin Locomotive Works, spoke on "Supersonics and Supersonic Wind Tunnels," at a meeting in the Engineers Club of Philadelphia, February 25.

Mr. Young discussed elementary subsonic and supersonic principles as a background for his talk on supersonic wind tunnels. The transonic flow problem was discussed, as well as the reasons why wind tunnels have not been satisfactory in the transonic region of flight. A comparison of subsonic and supersonic tunnels was presented with an extensive description of the wind tunnels at California and Cornell. The construction and various features of the supersonic wind tunnel at Aberdeen were described.

Mr. Young illustrated his talk with slides that included schlieren photographs of shock-wave formations on various types of missile shapes. Several slides showed the effects of shock waves bouncing from wind-tunnel walls, aircraft structures, and from each other.

An enthusiastic discussion period followed Mr. Young's talk, with emphasis on the difficulties encountered in obtaining desired conditions of flow in the supersonic wind tunnel. The showing of an N.A.C.A. film, *A Study of Airflow by Smoke*, concluded the meeting.

San Francisco Section

For the past several years the San Francisco Section has been inactive. But on March 6 a reorganizational meeting was held, officers were elected, and plans were made to hold two meetings a month.

The officers elected at this time were: Chairman, J. R. MacGregor; Vice-Chairman, Smith De France; Treasurer, A. S. Niles; Recorder, Don O. Horning; Program Chairman, Manley J. Hood; Meetings Chairman, R. T. Nilson; and Membership Chairman, Ivy Lee, Jr.

The first dinner and technical session of the reorganized section was held, April 1, at the El Jardin Restaurant, San Francisco. One hundred and three members and guests were present.

Harold K. Cheney, Chief Flight Test Engineer, Consolidated Vultee Aircraft Corporation, spoke on "Flight Testing of Guided Missiles."

The second speaker, Willis M. Hawkins, Chief Preliminary Design Engineer, Lockheed Aircraft Corporation, presented a paper on "A Design Investigation of Personal Type Planes."

Seattle Section

By Gene B. Williams, *Secretary*

Chairman G. S. Schairer presided at the meeting on March 6 at the Chamber of Commerce Building. Earl L. Jensen, Design Specialist, Boeing Aircraft Company, presented a paper, "Aircraft Furnishings and Passenger Equipment." Solutions to Mr. Jensen's general summary were presented by N. L. Rockafield, R. M. Otis, and A. H. Morgan, all of Boeing Aircraft Company.

Mr. Jensen outlined the design objectives and problems considered in the design of furnishings and equipment for the modern luxury air liner. A large attendance of air-line representatives prompted an extensive discussion of many individual features of the Boeing Stratocruiser subsequent to the conclusion of the formal paper. Attention was directed to several items on which future development can be focused.

Texas Section

By R. F. Pence, *Secretary*

Ninety-five members and guests attended a meeting, March 21, at the Blackstone Hotel in Fort Worth. Chairman H. T. Johnson outlined a suggestion submitted by the Boston Section: to judge papers presented at Sec-

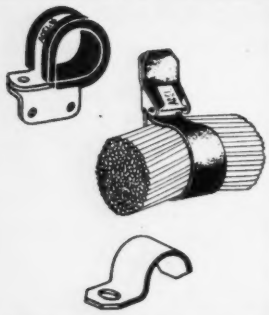
Calendar

I.A.S. Section Meeting

NIAGARA FRONTIER—June 19

Hotel Statler, Buffalo, N.Y.
Speaker: Dr. Hans Lundberg
"The Part of the Helicopter in a Geophysical Survey"

ADEL LINE SUPPORT CLIPS

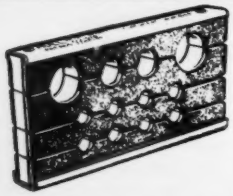


ADEL Clips provide a simple, rugged, low cost support for tubing, piping and electrical cables. Manufactured in over 13,000 different types and sizes. Over 330 million now giving dependable support in aircraft, marine and industrial installations.

ADEL Shock Absorbing Clips give cushioned support—insulate lines from vibration and wear.

ADEL Cable Harness Straps are self-adjusting supports accommodating single cables or any combination of wires. Positive locking device permits easy repair or replacement of wires. Loads to 2800 lbs.

ADEL LINE SUPPORT BLOCKS



A low cost, easily installed support for multiple grouping of lines. Provides rugged, resilient support eliminating line failures and fitting leakage caused by vibration. Available with hard maple, phenolic or **ADELITE** blocks in wide variety of sizes for accommodating 1 to 30 lines, ⅛" to 2½" in diameter.

ADELITE SYNTHETIC RUBBER

ADELITE—a tough, wear-resistant compound 26 to 33% lighter than conventional synthetic rubber. Impervious to aromatic vapors and liquids. Extremely low compression set. Permanent resiliency. Excellent sound insulating characteristics. Any hardness from 30 to 80 Shore Durometer. Available in wide variety patterns including channels, gaskets, pads, floor coverings and other molded forms.

Write for illustrated catalog containing complete specifications on more than 13,000 ADEL Clips and Blocks for aircraft, industrial and marine service.

ADEL

ADEL PRECISION PRODUCTS CORP.
BURBANK, CALIF. ★ HUNTINGTON, W. VA.

Manufacturers of: Aircraft Hydraulic Systems • Marine & Industrial ISOdraulic Controls • Halfco Self-Aligning Bearings • Line Support Clips & Blocks • Industrial Hydraulic Equipment • Aircraft Valves • Industrial Valves

tion meetings and place the Section winners in a regional competition. The response was inconclusive because members needed more time to consider the preparation of papers.

The speaker for the evening was C. G. Kirkbride, Professor of Chemical Engineering, Texas A. & M. College, and one of the 23 scientists requested by the Navy to observe the Bikini Atomic Bomb Test. His talk was illustrated with slides of the explosion. At the conclusion of his talk, an official technicolor Navy film describing the test was shown. Following a period of discussion, the meeting was adjourned.

Toronto Section

By Carl V Lindow, *Secretary*

On February 6, the first meeting of the officers of the Section was called by Chairman Ben Etkin. At this meeting committee chairmen were appointed as follows: R. D. Hiscocks, Program Committee; W. U. Shaw, Membership Committee.

It was decided that the Section would hold two Spring Meetings and two Fall Meetings this year. The date for the Annual Meeting of the Section was tentatively set for the third Wednesday in January.

On March 12 more than 100 members and guests were present at Hart House, University of Toronto, to hear Dr. G. N. Patterson deliver a paper on "Supersonics." After receiving his Ph.D. at the University of Toronto, Dr. Patterson spent several years at the Royal Aeronautical Establishment, Farnborough, England. At the beginning of the war he went to Australia, where he was responsible for the design and construction of an Aeronautical Laboratory including a transonic wind tunnel. During the past year his travels have taken him to the California Institute of Technology, Princeton, and, finally, the University of Toronto where he is now Professor of Aerodynamics.

Dr. Patterson began his talk by defining subsonic, transonic, and supersonic flow. He pointed out that supersonic flow problems are not problems of the future but problems with which we are now faced, since supersonic conditions exist at transonic and even subsonic airplane speeds.

The differences between the characteristics of Mach waves and shock waves were explained. A Mach wave can be either an expansion or compression with no change in entropy whereas a shock wave is a compression with an increase in entropy across the shock wave. A Mach wave can extend to infinity, since it is an infinitesimal disturbance that has no discontinuity; however, a shock wave always has a finite discontinuity.

The influence of Mach Number and wedge angle on the type of shock wave resulting was discussed. With a semi-wedge angle greater than about 45° there will always be a detached standing shock wave upstream.

The speaker went on to discuss the interaction between shock waves and the boundary layer. It was also pointed out that boundary layer suction should prove useful for subsonic flight with an airfoil designed to operate in the supersonic region.

In showing how shock waves can sometimes be used to advantage the speaker mentioned that diffusers for jet engines had been designed with higher efficiencies in the supersonic than in the subsonic region.

Dr. Patterson's talk was profusely illustrated with lantern slides. Particularly outstanding were some excellent interferometer photographs that showed clearly the density gradients associated with shock waves.

Following a lively question-and-answer period, sound motion pictures were shown depicting the various types of aircraft designed by de Havilland of England during the war and immediately afterward.

Washington Section

By Katharine Stinson, *Secretary*

On March 12, the Washington Section held a meeting in the United States Chamber of Commerce Building. W. E. Rhoades, Director, Air Navigation and Traffic Control, Air Transport Association, outlined the work now being done by the air lines and the Government in traffic control and aircraft landing aids.

It was pointed out that a landing system incorporating both I.L.S. and G.C.A. is not desirable, since pilots cannot be "traffic cops" in dense traffic. It was estimated that by 1955 there will be 1,800 airplane movements per day in the New York area.

The talk was illustrated with a motion picture and was followed by a period of discussion. Vice-Chairman M. B. Spaulding presided at the meeting.

Wichita Section

By Preston E. Dickson, *Secretary*

Members and guests of the Wichita Section met at the Shirkmere Hotel on February 6. Charles Seibel, Boeing Engineer, presented a paper on "Recent Developments of Helicopters." Mr. Seibel was associated with the Bell Aircraft Corporation during the development of the Bell helicopter. He emphasized the extreme difficulties encountered and the methods applied in achieving stability in the aircraft.

The paper was followed by three films that showed the development and flying characteristics of the Sikorsky, Bell, and Kellett helicopters. Mr. Seibel then answered questions from the floor on the safety features and the future prospects of helicopters.

On March 20, a technical meeting was held at the Drolls English Grill. John Kintas, Structural Research Engineer, Beech Aircraft Corporation, presented a paper on "Radio Telemetering of Flight-Test Data."

While on active duty in the U.S. Naval Reserve, Mr. Kintas was a member of the Structural Flight Test Section, Structures Branch, Bureau of Aeronautics. In that capacity he became familiar with some of the radio and television telemeters currently being used in flight-test work. Mr. Kintas discussed the problems that gave rise to the design of telemeters and explained the principles embodied in recently developed apparatus.

The discussion, supplemented by numerous slides, dealt with several multiplex radio systems and some aspects of television telemeters. He suggested increasing the utility of radio-control and telemetering equipment through development of monitoring devices that would reproduce in some remote control station the actual behavior of a test aircraft, its controls, and other related events during flight.

Alabama Polytechnic Institute

On February 10, Student Branch members met in Broun Hall to see two technical films. *Cyclone Combustion* showed the development of reciprocating engines by the Wright Aeronautical Corporation. *The Powerhouse of Aviation* described the mass production methods used in the manufacture of engines and engine parts during the war at Wright.

Forty-five members attended a meeting on February 25 in the Ramsey Engineering Building. Professor Gerald H. Backer, of the Aeronautical Engineering Department, reported on his trip to the I.A.S. Fifteenth Annual Meeting in New York. He also described his visits to Langley Field, Wright Field, the Navy Department in Washington, and the Chance Vought Aircraft Division of United Aircraft Corporation.

The following new officers were elected: Chairman, Wilmer H. Reed; Vice-Chairman, William R. Robinson; Secretary, Lionel L. Levy, Jr.; Treasurer, Reese H. Bricken.

Carnegie Institute of Technology

Philip E. R. Brice, Assistant Chief Engineer, Republic Aircraft Corporation, spoke to the Student Branch, February 20, on "Design and Development of the Republic." The election of the following officers was announced: Chairman, Burt L. Taylor; Vice-Chairman, R. J. Lewis; Secretary, A. R. Dismukes, Jr.; Treasurer, D. W. Watt.

The policy of having student members speak at each meeting is proving to be highly successful. A. R. Dismukes, Jr., spoke on "Weather and Its Importance to Aeronautical Engineers."

Plans are under way for a trip to the N.A.C.A. Laboratories in Cleveland during the month of April.

The meeting was concluded by the showing of a film, *Flight Test Picture of the XF-12.*

University of Detroit

On March 11, Philip G. Blenkush, Instructor of Aeronautics, University of Detroit, reported on the I.A.S. Fifteenth Annual Meeting in New York. A film, *Flutter Tests Run in the University of Detroit Wind Tunnel*, was shown. Plans were made to attend the National Aircraft Propulsion Meeting in Cleveland on March 28.

University of Illinois

The meeting on February 6 was opened by Chairman Albert D. Swanson who discussed the advantages and purposes of a student membership in the I.A.S.

Frank Coe, Director of Training, Chance Vought Aircraft Division, United Aircraft Corporation, talked on "The Future of the Aeronautical Engineer." He reported on the survey made by Dr. Karl T. Compton, President of the Massachusetts Institute of Technology, in which it was found that the demand for aeronautical engineers will continue to be heavy until 1950. After that time, the supply and demand for aeronautical engineers will be back to normal.

Indiana Technical College

On March 20, members of the Student Branch met to discuss plans for the May Convocation, sponsored by the Aeronautical Department, and to compile a schedule for future meeting dates.

University of Minnesota

Two hundred members and guests attended a meeting on February 27 to hear David Lewis, Jr., Chief Aerodynamicist, McDonnell Aircraft Corporation, speak on "Trends in High Speed Aircraft Design." Mr. Lewis discussed the swept wing and its future in avia-

tion, as well as aeronautics as a whole. A film, *The Phantom*, produced by the Princeton Film Center for the McDonnell Aircraft Corporation, described the construction of the Phantom.

Parks College of Aeronautical Technology

Lloyd Novak, Assistant Project Engineer, McDonnell Aircraft Corporation, spoke to members of the Student Branch, March 13, on "The Development of a Project." Mr. Novak presented some of the problems involved in designing and developing an airplane from the time it is first conceived until the prototype is built.

The following officers were re-elected: Chairman, Charles F. Jahn; Treasurer, Norman J. Painter. New officers are: Vice-Chairman, Andrew K. Helper; Recording Secretary, James McKenzie; Corresponding Secretary, Robert J. Marhefka.

The Pennsylvania State College

On March 26, the first organizational meeting of The Pennsylvania State College Student Branch was held. Dr. David J. Peery presided during the election of officers. The new Chairman, William Sunday, then took charge. Other new officers are: Vice-Chairman, Joseph Eisenhuth; Secretary, Irvin Mabry; Treasurer, William Barrett. Applications for 60 members were received.

Following the business session, a technical session was held jointly with the A.S.M.E. Samuel K. Hoffman, Professor of Aeronautical Engineering, The Pennsylvania State College, spoke on "The XR-7755 Lycoming Engine." Professor Hoffman outlined the development of the 5,000-hp. Lycoming engine, beginning with the design and testing of a single cylinder to the complete unit of 36 cylinders. Professor Hoffman was previously Chief Engineer, Lycoming Division, The Aviation Corporation, during the development of this engine. The meeting was closed by the showing of an Ethyl Corporation film, *Flames of Progress*.

Purdue University

On March 24, a joint meeting of the A.S.M.E., A.S.C.E., S.A.E., Tau Beta Pi Fraternity, and the I.A.S. Student Branch was held in the Electrical Engineering Building. David Lewis, Chief of the Aerodynamics Section, McDonnell Aircraft Corporation, spoke on "Trends in High Speed Aircraft." An open discussion of design problems that are encountered in building high-speed, high-altitude aircraft followed. The meeting was concluded by the showing of a film, *The Phantom*.

Rhode Island State College

The Rhode Island State College Student Branch held its first meeting on March 12. The following officers were elected: Chairman, Louis R. Hampton; Vice-Chairman, John Edwards; Secretary-Treasurer, William J. Duggan, Jr.

At a special meeting on March 26, Dr. Igor I. Sikorsky, a Senior Officer of the Branch, presented the members with the Institute credentials and student membership emblems.

Spartan College of Aeronautical Engineering

On February 14, a meeting of the Student Branch was held to discuss plans for the graduation banquet. Estill Sherrill and Donald Allen were appointed to make all arrangements.

The Constitution was amended as follows: Absentees are to be fined, provided that a meeting notice is posted three days in advance; new members will begin payment of dues on the first day of the first full month after application has been submitted; and the I.A.S.

JOURNAL will be loaned to members for a 3-day period.

Committee reports were made at the meeting on February 21. It was announced that the banquet would be held at the "Bit-of-Sweden."

A special dinner meeting was held on March 7 in honor of Donald Maddocks, graduating student. Professor Martin D. Saslaw presented Mr. Maddocks with a gift and commended him on his excellent scholastic record and for his cooperation in maintaining a worthy Student Branch during his term as Chairman.

The following officers were elected: Chairman, Estill Sherrill; Corresponding Secretary, Charles L. Gruenberg.

Stanford University

The Stanford Student Branch held its third monthly meeting on February 4. Plans were made for having a representative of Ames Laboratory present a paper on jet propulsion at the next meeting.

Arthur S. Benson, a graduate student, spoke on "The Effect of Bulkhead Flexibility on Shear Flow in Large Cut-Outs Made in Thin Wall Torsion Box Beams." C. V. Joga Rao, a student from India, presented a short paper on "Some Less Well Known Methods of Computing Beam Deflections."

Wayne University

On February 28, members of the Branch met to plan a meeting program for March. It was decided to invite members of the Detroit Glider Council, the University of Detroit and University of Michigan Student Branches, and members of the Detroit Section.

The meeting was adjourned following a film, *Planes Without Pilots.*

News of Members

The primary purpose of these columns is to record the current activities of Institute members and provide information that is of interest and value to other members.

All members are invited (in fact, urged) to send in releases or letters promptly informing the editors of any changes in positions, promotions, achievements, or other news items.

Lewis H. Abraham, formerly affiliated with Douglas Aircraft Company, Inc., and later Chief Engineer at the Empire Engineering Company, has returned to Douglas as a Structures Engineer.

Billy H. Amstead, former Production Engineer, Mission Manufacturing Company, has joined the Defense Research Laboratory at Austin, Tex., as a Research Engineer.

David F. Anderson is at present Head of Foreign Sales, Helicopter Division, Bell Aircraft Corporation. He was formerly a Group Captain in the R.A.F.

Warren G. Anderson has joined North American Aviation, Inc., as an Aerodynamicist. He was formerly Operations Engineer at Pan American Airways System.

Col. Albert A. Arnhym, A.A.F., has been promoted from Deputy Chief to Chief of Air Documents Division, Intelligence, T-2, Headquarters, Air Matériel Command, Wright Field, Ohio.

Harold G. Behl has transferred from Boeing Aircraft Company to Republic Aviation Corporation. His present assignment is Propulsion Development Engineer.

Seymour M. Bogdonoff, former Junior Aeronautical Engineer at the N.A.C.A. Langley Memorial Aeronautical Laboratory, is a Research Associate in the Aeronautical Engineering Department, Princeton University.

Frederick L. Brandau, following his discharge from the Navy, has returned to Lockheed Aircraft Corporation as a Flight Test Analyst.

Raymond O. Brittan, Northrop Research Engineer, has a temporary leave of absence to aid in a special project at Monsanto Chemical Company, Oak Ridge, Tenn. He is assigned to the Power Pile Division.

Witold Brzozowski is now affiliated with the Jet Helicopter Corporation as a Consulting Engineer. Prior to this position he was Chief Stressman at Fairchild Aircraft, Ltd.

Charles F. Burnham has joined The Draper Corporation as a Research Engineer.

Archie T. Chapel, former Layout Engineer, Boeing Airplane Company, is connected with the McDonnell Aircraft Corporation as an Assistant Stress Analyst.

Wei-Zang Chien is now Professor of Applied Mechanics, Department of Mechanical Engineering at the National Tsing Hua University in China. He was previously a Research Engineer at the California Institute of Technology.

Charles Chin is at present a Research Assistant at the Department of Aeronautical Engineering and Applied Mechanics, Polytechnic Institute of Brooklyn.

Harmon H. Crotsley, former Unit Head, Flight Test Engineering, Airplane Division, Curtiss-Wright Corporation, has joined North American Aviation, Inc., as an Aerodynamics Engineer.

Gene D. Davis is engaged as Senior Stress Analyst at McDonnell Aircraft Corporation.

Luis de Florez, President, de Florez Engineering Company, has been elected Vice-President of Doubleday Doran & Company, Inc.

Lester T. Dennis is connected with the C.A.A. as Aeronautical Engineer, Propeller Vibration Specialist in the Office of Safety Regulations. He was formerly a Stress Analyst at Curtiss-Wright Corporation.

Murray L. Deutsch has joined Socony-Vacuum Oil Company as a Physicist in the Research Laboratory.

Franklin W. Diederich has resigned his position as Instructor at New York University and is now an Aeronautical Engineer at the Langley Memorial Aeronautical Laboratory, N.A.C.A.

Charles G. Donovan, formerly a Draftsman at Douglas Aircraft Company, Inc., has returned to Douglas after his tour of duty in the Marine Corps. He is now an Engineering Artist.

Leo J. Foster, Jr., former Lt. Col., Army Air Corps, is now Chief Pilot for the Atlas Supply Company.

Robert E. Fowler, who before the war was Director of Public Relations at Air Associates, Inc., is now an Editor at Search & Rescue Publishing Company.

Jack H. Friedman has transferred from the American Central Manufacturing Corporation to Curtiss-Wright Corporation as Senior Engineer.

George L. Fruauff, Jr., has returned to General Motors Corporation as Final Inspector of the Frigidaire Division. He was formerly with Aeronca Aircraft Corporation.

Garland Fulton, Capt., U.S. Navy, has been elected a Director of the Luscombe Airplane Corporation.

William J. Furlick, former Service Engineer, Aeronca Aircraft Corporation, has joined Curtiss-Wright Corporation as a Flight Test Engineer in the Propeller Division.

Soli K. Ghaswala has resigned as Technical Assistant, Public Works Department, Government of Bombay, to join Concrete Construction & Engineering Company, Ltd., India, as Designing Engineer. In addition to this position, he is an Editorial Collaborator of *Science and Culture,* one of India's leading scientific and technical journals.

James J. Gruff, who prior to the war was a Stress Analyst at Meyers Aircraft Company, is now an Aeronautical Engineer with the C.A.A.

Edmund A. Guzewicz has joined the Revere Corporation of America as Development Engineer. He was formerly an Experimental Test Engineer with the Pratt & Whitney Aircraft Division, United Aircraft Corporation.

William N. Hall has resigned his position as Application Engineer at Elliott Company and has joined Bell Aircraft Corporation as an Electronic Engineer.

Albert T. Hapke, Jr., has been elected Secretary of the American Petroleum Industries Committee.

Wayne E. Harding, Jr., is at present an Engineer-Test Pilot for the Chance Vought Aircraft Division, United Aircraft Corporation.

Thomas L. Harmon, Jr., is associated with the Langley Memorial Aeronautical Laboratory, N.A.C.A., as an Engineer.

Chester N. Hasert, who before the war was connected with the Curtiss-Wright Corporation, is now an Aerodynamicist at the Aeroproducts Division, General Motors Corporation.

Richard E. Henke is affiliated with North American Aviation, Inc., as an Engineering Draftsman.

Edward B. Heyl, former Aviation Research Manager, McGraw-Hill Publishing Company, is now a Safety Engineer, Aero Insurance Underwriters.

Arnold W. Hohensee is instructing in the airplane shop of the Winter Haven High School in Florida. He was formerly a Design Engineer at Goodyear Aircraft Corporation.

Evert C. Hokanson has rejoined the Whiting Corporation as Manager of the Aviation Division.

Harold O. Hollenberg is at present employed in the Engineering Department of The Glenn L. Martin Company.

James M. Holmes is at present connected with the C.A.A. as an Aircraft Inspector.

Edward Holodnik is engaged as Junior Vibrations Engineer at The Glenn L. Martin Company.

John H. Hotson, former pilot for Norseman Air Transport of Canada, is now Superintendent of the Aviation Insurance Department of Stevenson & Hunt, Ltd.

Frederick W. Howells has joined the Consolidated Vultee Aircraft Corporation as an Aerodynamicist. He was formerly Detail Engineer at the Wichita Division of Boeing Airplane Company.

Richard B. Hulett is instructing in the Department of Mechanical Engineering at the Case School of Applied Science. He resigned his position as Senior Aerodynamicist at Curtiss-Wright Corporation.

Heighton D. James, former A.A.F. Engineer at Wright Field, has joined Northrop Aircraft Company, Inc., as a Structures Engineer.

James E. Jean has joined Menasco Manufacturing Company as Structures Engineer. Prior to active duty with the Navy, he was a Junior Stress Analyst at Lockheed Aircraft Corporation.

Frederick V. H. Judd, Powerplant Technical Engineer, Republic Aviation Corporation, has been awarded the S.A.E. Wright Brothers Medal for 1946. The Medal, awarded annually to the author of the best paper on aerodynamics, structural theory, or airplane design given before an S.A.E. meeting, was presented to Mr. Judd for his paper, "A Systematic Approach to the Aerodynamic Design of Radial Engine Installations." In his paper, Mr. Judd outlined a method, based largely upon original wind-tunnel research and data on airflow and drag characteristics of aircraft-engine installations, for designing the cowling without requiring forced cooling.

Frederick V. H. Judd.

George Kaden is affiliated with the Link Aviation Devices, Inc., as an Engineer.

Paul Kleinman, former Draftsman at Consolidated Vultee Aircraft Corporation and later Stress Analyst at the Edo Aircraft Corporation, is a Production and Design Engineer at Norden Manufacturing Company.

Bert Lesser is now a Structural Engineer with the Sikorsky Aircraft Division, United Aircraft Corporation.

Melvin W. Lifson is associated with the United Aircraft Corporation as an Engineer. Prior to this position he was an Aerodynamicist at the Consolidated Vultee Aircraft Corporation.

Carl V. Lindow, Senior Stress Analyst, has joined A. V. Roe Canada, Ltd.

Herman R. Lorence, Jr., previously a Junior Stress Analyst at Bell Aircraft Corporation, is now a Stress Analyst at The Ryan Aeronautical Company.

David E. Lukens has been appointed General Manager of the Philadelphia Tube Company. He will continue as Engineering Representative for the Autogiro Company of America. Mr. Lukens was formerly Sales Engineer of the Summerill Tubing Company. He has been connected with the seamless steel tubing industry for the past 19 years.

James H. Maravel is Junior Aerodynamicist at The Glenn L. Martin Company.

James D. McEwan is engaged as a Project Flight Test Engineer on the FD-1 Jet Navy Fighter, McDonnell Aircraft Corporation.

Andrew I. McKee, Jr., former Structural Design Engineer at Douglas Aircraft Company, Inc., is now a Structures Engineer for Chance Vought Aircraft Division, United Aircraft Corporation.

Jack L. McLarty is at present affiliated with R. E. Young Consultant Engineers.

Robert J. Millson has joined the Research Department of D. Napier and Sons Ltd., England. He is a Senior Technical Assistant.

Wesley C. Mock, Jr., former Assistant Physicist, Aerodynamics Section, National Bureau of Standards, has joined The Radiart Corporation as Chief Engineer.

Robert D. Morris, Draftsman, has resigned his position with Pan American Airways System and has joined the General Engineering and Consulting Laboratory, General Electric Company.

Corliss C. Moseley has been elected President and General Manager of the Grand Central Airport Company. He was formerly President of the Aircraft Industries Inc.

Miles J. Mraz, Designer, has returned to North American Aviation, Inc., after a tour of active duty with the Army Engineers Corps.

Arthur T. Newell has been elected President of Arthur T. Newell & Company. Prior to this position he was President and Chief Engineer of the Kenyon Instrument Company, Inc.

Robert D. Norvell, Engineering Draftsman "A," has transferred from Douglas Aircraft Company, Inc., to the Consolidated Vultee Aircraft Corporation.

Harold E. Oppenheim is at present a Project Engineer with the Bureau of Aeronautics, Navy Department.

Oliver L. Parks, President of Parks Air College, has been appointed a member of the Non-Scheduled Flying Advisory Committee of the C.A.A.

Edward Pepper, former Aeronautical Engineer at Langley Memorial Aeronautical Laboratory, N.A.C.A., is now a Project Engineer at the Naval Aircraft Modification Unit, Johnsville, Pa.

Eugene S. Peterson has joined the Cornell Aeronautical Laboratory as a Junior Aerodynamicist in the Wind Tunnel Department. He was formerly associated with Consolidated Vultee Aircraft Corporation.

Albert A. Pinto, who before the war was a Junior Stress Analyst at The Glenn L. Martin Company, is engaged as Design Engineer at Pinto Brothers.

John L. Potter, former Installations Aerodynamicist in the Curtiss-Wright Propeller Division, has joined the faculty of the Department of Aeronautical Engineering, University of Alabama.

Ernest F. Relf, former Superintendent, Aerodynamics Department, National Physics Laboratory, England, has been appointed Principal of the College of Aeronautics, England.

Lewis A. Rodert, previously affiliated with Stewart-Warner Corporation as a Research Engineer, is now Chief of the Flight Branch, Aircraft Engine Research Laboratory, N.A.C.A.

John H. Schneider, former Captain in the Structures Branch, Aircraft Laboratory, A.A.F., Wright Field, has been appointed Sales Engineer of the Pennsylvania Salt Manufacturing Company.

Arthur R. Weckel.

John C. Schroeter has been elected Vice-President of the Hageman Properties, Inc. He was formerly Manager of Pan American World Airways System's Africa-Orient Division.

Laurence W. Sheridan is now an Associate Professor of Mathematics at The College of St. Thomas.

Stanley H. Simmons is currently engaged at Los Alamos Scientific Laboratories as Design Engineer. He was formerly Junior Engineer at Pan American World Airways System.

Robert L. Slifer has returned to Mid-Continent Airlines, Inc., following duty in the Army Air Forces. He has been promoted to Senior Meteorologist.

Richard E. Smith, formerly a Detail Design Engineer at Boeing Aircraft Company, is now a Consultant Engineer, Engineering Clinic.

Leo S. Smyth, Flight Lieutenant, Royal Australian Air Force, is at present on technical duties in England regarding production of the de Havilland Vampire.

Robert R. Stark, former Test Engineer at Wright Aeronautical Corporation, is now Assistant to the Chief Engineer, Eastern Air Lines, Inc.

John R. Stiles, formerly in charge of Installations and Hydraulics Sections of the Consolidated Vultee Aircraft Corporation, is now Assistant to the President of the Pedlow Machine Company.

Donald E. Strand is engaged as Junior Engineer at Boeing Aircraft Company.

Arthur R. Weckel, former Aeronautical Sales Manager of Sperry Gyroscope Company, Inc., has been appointed Director of Commercial Sales. He is responsible for all commercial product sales and service in the United States and Canada.

Robert R. Stark.

James E. Whiston, previously affiliated with Bell Aircraft Corporation, is now connected with the New Design Group, The Ryan Aeronautical Company.

Burdette S. Wright, Vice-President of the Curtiss-Wright Corporation, has been elected Chairman of the Eastern Region Public Relations Advisory Committee of the Aircraft Industries Association.

Members Elected

The following applicants for membership or applicants for change of previous grades have been admitted since the publication of the list in the last issue of the REVIEW.

Elected to Associate Fellow Grade

Berg, Alfred Gordon, B. of Engineering; Chief, Airworthiness Section, Provisional International Civil Aviation Organization (Canada).

Transferred to Associate Fellow Grade

Crocker, Albert Rudolph, M.S. in Ae.E.; Chief of Experimental Test Lab., Engineering & Research Corp.

Kupiec, Harry Peter, B.S. in Ae.E.; Chief Hydraulics Engineer, Air Associates, Inc.

Marx, Harry Joseph, President, Van Muffling & Marx Organization, Inc., Consulting Engineers.

Parsons, John Frederick, M.E. in Aeronautics; Chief Aero. Engineer (P8), Chief of Full Scale and Flight Research Div., Ames Aero. Lab., N.A.C.A.

Seidman, Oscar, M.Sc.; Principal Aero. Engineer, Head of Test Analysis Section, Aero. & Hydro Branch, Bureau of Aeronautics, Navy Dept.

Smith, Stanley Wilson, B.S. in Ae.E.; Project Engineer, Bell Aircraft Corp.

Sylvander, Roy Cornelius, B.S. (Mech.); Director of Engineering, Eclipse-Pioneer Div., Bendix Aviation Corp.

Tweney, George Harrison, M.S. in Ae.E.; Professor of Aero. Engineering, Wayne University.

Elected to MEMBER Grade

Axt, Wallis Clayton, M.E.; Seaplane Development Engineer, Experimental Towing Tank, Stevens Institute of Technology.

Birnn, Herbert George, Draftsman & Engineer, Grumman Aircraft Engineering Corp.

Bolles, Frank Crandall, Jr., B.S.; Comdr., Asst. Assembly and Repair Officer, U.S. Navy.

Campani, Louis M., B.S. in E.E.; Electrical Engineer, The Liquidometer Corp.

Carlton, Paul Ranney, Field Engineer, Curtiss-Wright Corp.

Collins, Benjamin Franklin, Jr., Designer "B," Douglas Aircraft Co., Inc.

Dallas, Allen W., B.Ae.E.; Director, Engineering Div., Air Transport Association of America.

David, Frederick William, Eng. Dipl. (Mech. Engr.); Chief Designer, Aircraft Div., Commonwealth Aircraft Corp. (Australia).

Davis, Frank Wilbur, B.S. in M.E.; Asst. Chief Development Engineer, Consolidated Vultee Aircraft Corp.

Dodson, Joseph Edward, S.M. in Ae.E.; Capt., Assembly and Repair Officer in charge of Dept., Repair & Overhaul, U.S. Navy.

Dzung, Lang Shuen, S.M. in E.E.; Engineer, Brown, Boveri & Co. Ltd. (Switzerland).

Falk, Karl Hansson, Engineering Degree (Mechanics & Chemistry); Design Supervisor, Hamilton Standard Propellers Div., United Aircraft Corp.

Govinda-Raghavan, Venkata-Narasimhaiyya, M.Sc. in Ae.E.; Technical Asst., Tata Airlines (India).

Gunkel, Vernon Kenneth, M.S.; Asst. Professor, Alabama Polytechnic Institute.

Harrison, Neil Milford, B.S. in Ae.E.; Staff Division Engineer, Lockheed Aircraft Corp.

Haythorne, Percy Allen, Research Engineer, Lockheed Aircraft Corp.

Jones, Loren F., B.S. in E.E.; Manager, Research and Development Projects, RCA Victor Div., Radio Corp. of America.

Kollin, George, M.S.; Research Engineer, Republic Aviation Corp.

Ladousee, Albert, Lt. Col., Engineer, Asst. Air Attaché, French Embassy (Washington, D.C.).

Lange, Roy Harrison, B.S.; Aeronautical Engineer P-3, Langley Mem. Aero. Lab., N.A.C.A.

Levy, Samuel, M.S. in E.E.; Physicist, Mechanics of Aircraft Structures, National Bureau of Standards.

Lieber, Paul, M.S.; Asst. Professor of Applied Mechanics, Polytechnic Institute of Brooklyn.

Lindberg, Robert William, A.A.; Materials and Process Engineer, Aviation Maintenance Corp.

Litchford, George Barrett, B.A.; Sr. Project Engineer, Aircraft Radio Dept. (Research Lab.), Sperry Gyroscope Co., Inc.

Lucien, René, Directeur Technique, Societe Messier (Paris).

Marino, Alfred Anthony, B.S. in M.E.; Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Mason, Douglas Frederick, B.S.; Lt. Comdr., Technical Representative for Canadian Industries, Limited (Canada).

McConnaughhay, James William, M.S. in Ae.E.; Lt. Comdr., Executive Officer, BAR (Pasadena), U.S. Navy.

Meyer, John H., B.S. in C.E.; Chief Structural Engineer, McDonnell Aircraft Corp.

Oldfield, Homer Ray, Jr., M.S. in Ae.E.; in charge Army Air Forces Sales, Electronic Dept., Govt. Div., General Electric Co.

Orr, Andrew William, Jr., M.S.; Chief Engineer, Aircraft Projects, Research Dept., Holley Carburetor Co.

Pinaire, John Sherman, B.S. in Ae.E.; Power Plant Group Engineer, Lockheed Aircraft Corp.

Pitt, William Granger, B.S.; Specification Engineer, Lockheed Aircraft Corp.

Prince, David Chandler, Jr., A.B.; Technical Engineer, General Electric Co.

Quinn, John Henry, Jr., B.S.; Research Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Richmond, Henry Thomas, Asst. Group Service Engineer, Boeing Aircraft Co.

Roy, Kiran Kumar, M.Sc.; Manager and Director (Technical), Airways Limited (India).

Schleicher, Richard Leon, M.E.; Chief Structures Engineer, North American Aviation, Inc.

Shoor, Bernard Alan, B.A.; Research Lab. Analyst "A," Douglas Aircraft Co., Inc.

Templeton, Robert Reade, B.S. in Ae.E.; Asst. Manager, Technical Data Div., Wright Aeronautical Corp.

Thieme, Walter I., B.S. in M.E.; Engineering Test Pilot, Fairchild Aircraft Div., Fairchild Engine & Airplane Corp.

Tillou, Joseph H., M.A. (Bus. Adm.); Production Supt., Fairchild Aircraft Div., Fairchild Engine & Airplane Corp.

Victor, Abraham J., M.E.; Instructor, Cal-Aero Technical Institute.

Weller, Dan W., M.E. (Aero. Option); Chief Flight Test Engineer, Fairchild Aircraft Div., Fairchild Engine & Airplane Corp.

Williamson, Arthur Joseph, M.S. in Metallurgy, B.S. in Mining Engineering; Plant Manager, Summerill Tubing Co.

Williamson, Robert Charles, B.M.E.; Engineer, Project Hermes, General Electric Co.

Withington, Kenneth, Ae.E.; Professor, Head, Aero. Engineering Dept., Mississippi State College.

Wolfson, Miles King, B.S.E.; Technical Engineer, General Electric Co.

Transferred to MEMBER Grade

Adrian, Joseph Leonard, B.S. in Ae.E.; Asst. Project Engineer, Propeller Design Section, Propeller Div., Curtiss-Wright Corp.

Allsop, Arthur Wesley, B.S. in Ae.E.; Service Engineer, Lockheed Aircraft Corp.

Anthony, Riley E., S.B. in M.E.; Engineer, Aerophysics Dept., Goodyear Aircraft Corp.

Baals, Donald Delbert, M.S. in Engineering; Head of the 4-Ft. Supersonic Tunnel Project, Langley Mem. Aero. Lab., N.A.C.A.

Ballou, Luther Farwell, Jr., Designer "A," Power Plant Group, Consolidated Vultee Aircraft Corp.

Beemer, Harold Russell, B.Ae.E.; Stress Analysis Engineer, Douglas Aircraft Co., Inc.

Bell, E. Barton, Ae.E.; Aero. Engineer, Propulsion Consultant, Guided Missiles Section, Air Matériel Command, Wright Field.

Berinati, Vincent James, B.Ae.E.; Chief of Structures, Fairchild Personal Planes Div., Fairchild Engine & Airplane Corp.

Berler, Irving, M.S. in Ae.E.

Binegar, Lewis Albert, B.S. in General Engineering; Flight Test Analysis Engineer, Flight Test Unit, Boeing Aircraft Co.

Blake, Tenney Elmore, B.S. in C.E.; Engineering Editor, Aircraft Research & Development Div., Willys-Overland Motors, Inc.

Blatz, William Joseph, B.Ae.E.; Project Aerodynamicist, McDonnell Aircraft Corp.

Bobrowsky, Alfred Randolph, M.S.E.; Head, High Temperature Materials Section, Aero. Engine Research Lab., N.A.C.A.

Boetel, Victor Frank, B.S. in Ae.E.; Structural Design Engineer, Northrop Aircraft, Inc.

Bonney, Everard Arthur, M.S. in Ae.E.; Project Supervisor, Applied Physics Lab., Johns Hopkins University.

Boon Hartsinck, Adriaan Antoni, Associate, Alvin P. Adams and Associates.

Boxer, Emanuel, B.Ae.E.; Aero. Engineer (P-3), Project Engineer on Propeller & Compressor, Development Work, Langley Mem. Aero. Lab., N.A.C.A.

Branson, Orland D., B.S. in E.E.; Test and Fabrication of Guided Missiles, Pacific Div., Bendix Aviation Corp.

Bratt, Robert William, M.S. in Ae.E.; Member of Aerodynamics Branch, Douglas Aircraft Co., Inc. (El Segundo Plant).

Brooks, Frederick Thomas, Engineering Liaison "A," Lockheed Aircraft Corp.

Broome, Joseph Wesley, B.S. in E.E.; Development Engineer, Bell Aircraft Corp.

Bullivant, Walter Kenneth, B.Ae.E.; Flight Test Analyst, Consolidated Vultee Aircraft Corp. (Ft. Worth Div.).

Burkheimer, George E., B.S. in Ae.E.; Research Group Engineer in charge of Supersonic Wind Tunnel, Lone Star Lab., Consolidated Vultee Aircraft Corp.

Bush, Walter Roy, B.Ae.E.; Principal Research Engineer, Republic Aviation Corp.

Bush, Wilfred Francis, B.Ae.E.; Research Lab. Analyst "A," Lockheed Aircraft Corp.

Camping, Robert Lewis, M.S. in Ae.E.; Supervisor, Blade and Spinner Design, Aeroproducts Div., General Motors Corp.

Carlson, Carl Lawrence, B.Ae.E.; Asst. Project Engineer, Pratt & Whitney Aircraft Div., United Aircraft Corp.

Carroll, Frank Theodore, Jr., B.S. in M.E.; Instructor in Engineering, Louisiana State University.

Carter, George Daniel, B.S. in M.E.; "A" Structures Engineer, Boeing Aircraft Co. (Seattle Div.).

Champney, William Brooks, M.S. in M.E.; Section Head in charge of 12-Ft. Variable Density Wind Tunnel, Cornell Aero. Lab.

Clark, Robert George, B.S.; Engineering Designer, The Glenn L. Martin Co.

Crabtree, James Arnold, B.S. in Ae.E.; Chief Weight Engineer, Hughes Aircraft Co.

Crane, Leon, M.S. in Ae.E.; Aerodynamicist and Flight Test Engineer on Helicopters, G & A Aircraft, Inc.

Crawford, Robert, 1st Lt., Aero. Engineer, Design and Development Officer, U.S. Army Air Forces.

Crook, James Morvin, B.S. in Ae.E.; Project Structural Engineer, Fairchild Aircraft Div., Fairchild Engine & Airplane Corp.

Dallenbach, Frederick, A.A.; Preliminary Design Engineer, Douglas Aircraft Co., Inc.

Daughaday, Hamilton, Jr., M.S. in Ae.E.; Helicopter Vibration Engineer, Bell Aircraft Corp.

Day, Wilbur Hastings, B.S.; Aerodynamicist, Curtiss-Wright Corp.

Dobbins, David Trowbridge, B.S.; Chief Structures Salvage Engineer, North American Aviation, Inc.

Dowell, Eugene Harris, B.M.E.; Asst. Engineer, Aerodynamics and Structural Analysis, The de Havilland Aircraft of Canada, Ltd. (Canada).

Dudek, Oldrich, B.Ae.E.; Structures Engineer, Republic Aviation Corp.

Eddy, Elwin H., M.S. in Ae.E.; Col., Design and Development Engineer, U.S. Army Air Forces.

Ehmcke, William Knox, B.S. in M.E.; Sr. Flight Test Engineer (Commercial Airplanes Group), Consolidated Vultee Aircraft Corp.

Epps, Luther Macon, Jr., Master of Ae.E.; Structural Engineer-Group Leader in Charge of Stress Analysts, Grumman Aircraft Engineering Corp.

Epstein, Aaron, B.S. in M.E. (Aero. Option); Structures Engineer, Consolidated Vultee Aircraft Corp.

Erickson, Norvin Elwood, B.Ae.E.; Rocket Development Engineer, Bell Aircraft Corp.

Erotas, James Thomas, B.S. in Ae.E.; Sr. Layout Engineer (Lofting), Master Lines Group, Goodyear Aircraft Corp.

Estabrook, George Herbert, Sr. Design Engineer, Lockheed Aircraft Corp.

Etkin, Bernard, B.A.Sc. (Aero. Option); Lecturer in Aeronautics, University of Toronto.

Farrah, Jere Tiffin, B.S. in Eng. (Ae.E. and M.E.); Manager, Aircraft Procurement Branch, American Airlines, Inc.

Fiedler, Henry, Ae.E.; Sr. Stress Analyst, Goodyear Aircraft Corp.

Finley, Henry Bassett, Weight Engineer, G & A Aircraft, Inc.

Fischer, Harold Samuel, M.S. in Ae.E.; Aerodynamics Engineer "A," Douglas Aircraft Co., Inc.

Flatt, Joseph, B.Ae.E.; Chief, Design Aero. Unit, Aerodynamics Branch, Aircraft Lab., U.S. Army Air Forces, Wright Field.

Flushman, David, B.S. in Ae.E.; Weight Control Engineer, Douglas Aircraft Co., Inc.

Francis, Harold Eugene, B.S. in M.E.; Asst. Project Engineer, Wright Aeronautical Corp.

Frank, Arnold J., B.S.; Flight Test Analyst, Consolidated Vultee Aircraft Corp.

Franklin, Elmer Sherwood, M.S. in Ae.E.; employed by the Kellex Corp. of New York City. Assignment at the Applied Physics Lab., Johns Hopkins University, as Project Supervisor of Ground and Flight Testing.

Fuller, Stuart Jamieson, Jr., B.Ae.E.; Major, Chief Training Div., Air Weather Service, U.S. Army Air Forces.

Furlong, G. Chester, B.Ae.E.; Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Gero, Doane Russell, M.S. in Ae.E.; Staff Engineer, Goodyear Aircraft Corp.

Gitt, Edward, Ae.E.; Republic Aviation Corp.

Gorton, Robert Elsbre, M.Ae.E.; Project Engineer in Charge of Instrumentation Group, Experimental Test Section, Pratt & Whitney Aircraft Div., United Aircraft Corp.

Grimstad, Edward Franklin, B.Ae.E.; Project Engineer, Aircraft Weight Control, Mid-Continent Airlines, Inc.

Griswold, William George, Jr., Ae.E.; Engineer, Flight Test Section, Flight Dept., Consolidated Vultee Aircraft Corp.

Grube, Karl Peter, A.B.; Director, Contract Requirements, Sales Div., Douglas Aircraft Co., Inc.

Harmer, Harold J., B.S.; Structural Test Lead Engineer, Boeing Airplane Co.

Helweg, Paul Frederiksen, Supervisor (Installations), Chance Vought Aircraft Div., United Aircraft Corp.

Herbert, Fred Davis, Jr., B.S. in M.E.; Vice-President, Kearfott Company, Inc.

Hockman, Marion Thomas, B.S. in M.E.; Head, Navy Aerodynamics Unit, Curtiss-Wright Corp. (Columbus Plant).

Hokanson, Evert Carl, B.S. in M.E.; Manager, Aviation Div., Whiting Corp.

Hong, Jim, B.S. in Ae.E.; Aerodynamics Engineer, Lockheed Aircraft Corp.

Howe, William Robert, Jr., B.S. in M.E.; Power Plant Design & Analysis Group, Curtiss-Wright Corp.

Janis, Charles Laurren, Layout Designer, The Glenn L. Martin Co.

Jensen, Ernest William, Jr., B.Ae.E.; Power Plant Development Engineer, Boeing Aircraft Co.

Jesse, Ferdinand Leopold, Designer, General Motors Corp.

Jongeneel, James William, M.S. in Aeronautics; Power Plant Test and Analysis Group Leader, Douglas Aircraft Co., Inc.

Kastan, Howard, B.Ae.E.; Research Engineer, Structural Research Lab., Lockheed Aircraft Corp.

Kaufman, Harold, B. S. in M.E. (Aero. Option); Supervisor of Aerodynamics Group engaged in Pilotless Aircraft Development, Naval Aircraft Modification Unit (Philadelphia).

Kelley, Joseph, Jr., M.S. in Aeronautics; Capt., Chief, Design Criteria Unit, Air Matériel Command, Wright Field.

Kenger, Arthur, B.S. in Ae.E.; Structural Design Engineer, East Coast Aeronautics, Inc.

Kleinman, Joseph Maurice, B.S. in M.E.; Instructor, Vocational Training, A.A.F. Technical Training Command (Chanute Field).

Knopf, George Stanbury, B.M.E.; Head, Aircraft Design Section, Fairchild Engine & Airplane Corp.

Krieger, Stuart Alvin, B.S. in Engineering; Supervisor of Aerodynamics Section, Northrop Aircraft, Inc.

Kurrasch, Leslie Franklin, B.Ae.E.; Engineering Designer "A," Leadman, Controls Design Group, Douglas Aircraft Co., Inc. (El Segundo Plant).

Laitone, Edmund Victor, M.S. in Applied Math.; Principal Aero. Engineer, Cornell Aero. Lab.

Larson, Lorell Vincent, B.Ae.E.; Asst. for Planning, Mechanical Branch of Equipment Lab., Engineering Div., War Dept. (Wright Field).

Lilligren, Robert Warren, B.Ae.E.; Development Engineer, The Wayne Pump Co.

Lin, Chia-Chiao, Ph.D.; Assoc. Professor, Brown University.

Lundgren, Arthur Stanley, Group Leader, Douglas Aircraft Co., Inc.

Lusty, Cameron Nathaniel, B.Ae.E.; Development Engineer, Aircraft Div., Globe Corp.

Maleske, Alexander Robert, B.S. in Ae.E.; Aero. Engineer, Asst. Handbook Unit Chief, Air Matériel Command, Wright Field.

Mastrocola, Nicholas, B.S. in Ae.E.; Project Engineer, Pilotless Aircraft Div., Langley Mem. Aero. Lab., N.A.C.A.

Mercier, Clifford C., B.Ae.E.; Sr. Aerodynamicist, Supersonic Research, Pilotless Aircraft, The Glenn L. Martin Co.

Mertens, Donald Arthur, Leadman—Fixed Equipment, Supervising Layout and Detail Drafting, Bell Aircraft Corp.

Mikulka, Stanley William, B.M.E.; Supervisor, Muroc Flight Test Group, General Electric Co.

Muhlhauser, Alfred Eugene, Ae.E.; Structures Engineer, Aeronca Aircraft Corp.

Nesbitt, Edward James, M.S. in Ae.E.; Sales Engineer, Sikorsky Aircraft Div., United Aircraft Corp.

Newby, Clinton Toms, M.S. in Ae.E.; Stress Analyst, Douglas Aircraft Co., Inc.

Newman, Clyde Alexander, B.S. in E.E.; Engineering Designer "A," Lockheed Aircraft Corp.

Nichols, Harry A., M. A.; Project Engineer, Douglas Aircraft Co., Inc.

Nierenberg, Byron, B.S. in Ae.E.; Unit Leader, Republic Aviation Corp.

Numbers, William, B.S. in Ae.E.; Sr. Field Engineer, Ranger Aircraft Engine Div., Fairchild Engine & Airplane Corp.

Nunziato, Ralph Joseph, B.Ae.E.; Capt., Design & Development Officer, U.S. Army Air Forces.

Nystrom, Herbert Charles, B.S. in Ae.E.; Engineering Designer, Lockheed Aircraft Corp.

O'Neal, William Brechner, M.E.; Chief, Power Plant Design Section, The Glenn L. Martin Co.

Peirce, Carroll Joseph, M.S. in Ae.E.; Director of School of Aviation, Ohio State University.

Pfaff, George Charles, Jr., B.S.; Stress Group Engineer, The Glenn L. Martin Co.

Philipp, Paul Alois, A.A. in Ae.E.; Structural Design Engineer "B," Wing Structures, Lockheed Aircraft Corp.

Phinizy, William Harison, B.S.; Flight Engineer & Engineering Test Pilot, North American Aviation, Inc.

Pinkos, Alfons Marion, B.S. in Ae.E.; Martin New Design Div., The Glenn L. Martin Co.

Pitman, Wayland Andrew, B.S. in Ae.E.; Head, Structural Development, Chance Vought Aircraft Div., United Aircraft Corp.

Platt, Fletcher Nicholson, B.S. in Ae.E.; Chief Design Engineer, Rheem Manufacturing Co.

Preston, George Merritt, B.Ae.E.; Head of Flight Engineering Section, Aero. Engine Research Lab., N.A.C.A.

Reynolds, Francis Drake, B.S. in M.E.; Major Engineer (Physical Research Group), Boeing Aircraft Co.

Richmond, Robert Dick, B.S.E. in Ae.E.; Chief of Aerodynamics, Fairchild Aircraft Ltd. (Canada).

Robinson, Theodore Douglas, B.S.E. (Aero.); Structures Engineer, Grumman Aircraft Engineering Corp.

Rosenberg, Reinhardt Mathias, B.S. in Engineering; Instructor in Dynamics, Vibration, and Flutter, Purdue University.

Rowland, Arthur E., B.Ae.E.; Asst. Professor of Aero., Virginia Polytechnic Institute.

EXPLOSIONS!

Like a handkerchief over a sneeze, a metal screen over a flame prevents the spread of an explosion. Flame safety lamps have for years used this principle. Now, General Electric has developed a lightweight control box that accomplishes the same purpose. In its cover (see picture) is a sintered bronze screen that confines an internal explosion, yet dissipates the pressure—eliminating the need for heavy construction. Flame will not pass through.

Partner to the control is a new explosion-proof motor developed recently by General Electric and tested at the Underwriters' Laboratories. The motor is no larger, weighs no more than a standard aircraft motor of comparable rating, yet its unique construction (employing special seals and flanges) has received Underwriters' approval. Both of these devices will be real factors in removing one of the most dreaded hazards of flight.

G-E research on electric equipment of all types, aircraft gas turbines, turbo-superchargers, and many other devices for aircraft goes forward, as it did during the war, to make American aviation the finest in the world. Contact our nearest office for further information; our engineers will be glad to discuss electrical applications with you. *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

PRECISION PRODUCTS
AND
ENGINEERED SYSTEMS
FOR AIRCRAFT

GENERAL ELECTRIC

233-8

Rubin, Arnold Ernest, B.S. in Ae.E.; Sr. Design Engineer, Wing and Prototype Designs, Lockheed Aircraft Corp.

Rychetsky, Rudolf Arthur, Layout Designer, The Glenn L. Martin Co.

Sadoff, Melvin, B.Ae.E., Bus. Adm.; Aero. Engineer (P-3), Flight Research, Ames Aero. Lab., N.A.C.A.

Sharp, Charles Willard, B.S. in M.E. (Aero. Option); Stress Group Engineer, Control System, The Glenn L. Martin Co.

Simon, Sali Thomas, B.S. in M.E. (Aero.); Lt. Comdr., Technical Air Intelligence, Aircraft Experimental Development Squadron, Bureau of Aeronautics, U.S. Navy.

Skoog, James Arthur, B.Ae.E.; Stress Analyst "A," Boeing Aircraft Co.

Smith, Rodney Hobson, S.M.; Asst. Professor, Dept. of Aero. Engineering, Massachusetts Institute of Technology.

Spivack, Herman Melville, M.S.; Research Analyst, Aerophysics Lab., North American Aviation, Inc.

Stern, John Alfred, M.S.; Aircraft Engineer, United Air Lines, Inc.

Stern, Robert Gottlieb, B.S. in Eng. Physics; Sr. Aerodynamicist, Curtiss-Wright Corp.

Stevens, Blaine Kelly, B.S. in Ae.E.; Project Engineer, Lear, Inc.

Strickland, John Thorpe, M.S. in Ae.E.; Asst. Project Engineer, Pilotless Plane Div., Fairchild Engine & Airplane Corp.

Stubbs, George Rozzle, B.S. in Ae.E.; in Charge of Flight School, College of St. Thomas.

Sutton, Robert James, B.Ae.E.; Consultant, Tooling Dept. on Materials and Processes, Douglas Aircraft Co., Inc.

Swanson, Robert S., B.S. in Eng.; Research Work in Supersonic Airfoil Theory, Ames Aero. Lab., N.A.C.A.

Sweberg, Harold Henry, B.S. in Ae.E.; Aero. Engineer (Research Aerodynamicist), Langley Mem. Aero. Lab., N.A.C.A.

Tinney, Howard Charles, B.S. in Ae.E.; Aerodynamicist "A," Boeing Aircraft Co.

Tsien, Hsue-Chu, M.S. in Ae.E.; Chief, Industry & Mining Dept., Chinese Supply Commission.

Turbett, Frank Joseph, Ae.E.; Sr. Development Engineer, Airplane Design, Goodyear Aircraft Corp.

Urquhart, Robert Gordon, M.S. in Ae.E.; Asst. Professor in Aeronautics, University of Minnesota.

Valcheck, Frank J., B.S. in Ae.E. and M.E.; Engineering Designer, Lockheed Aircraft Corp.

VanEvery, Kermit Edwin, M.E. in Aero.; Chief of Aerodynamics Section, Douglas Aircraft Co., Inc. (El Segundo Plant).

Voglewede, Thomas J., B.Ae.E.; Head of Flight Performance Section, Flight Research Div., Langley Mem. Aero. Lab., N.A.C.A.

Wagner, Francis Vincent, M.M.E.; Structures Project Engineer, North American Aviation, Inc.

Waring, Henry Francis, Jr., B.Ae.E.; Engineering Test Pilot and Flight Analyst, Cessna Aircraft Co.

Weiner, Henry H., B.S. in M.E.; Management Engineer, NAMU—Navy Dept. (Pa.).

Westbrook, Charles Bevans, M.S. in Ae.E.; Stability and Control Engineer, Aircraft Lab., Engineering Div. (Wright Field).

Wetherbee, Arthur Everett, Jr., B.S. in M.E.; Research Dept., Pratt & Whitney Aircraft Div., United Aircraft Corp.

Wirtz, Justin Hubert, B.S. in Ae.E.; Design Specialist, Goodyear Aircraft Corp.

Wolcott, Charles Gordon, B.S. in M.E.; Account Executive, Consolidated Vultee Aircraft Corp.

Wright, Fred Asbery, B.S. in M.E.; Designer, Landing Gear & Hydraulics, Douglas Aircraft Co., Inc.

Yassin, Ivor Benjamin, M.S.; in Charge of Structures, Burnelli CBY-3, Central Aircraft Co.

Yui, Sing Fuh, B.S. in Physics, M.S. in Engineering; Aerodynamicist, Research Group, North American Aviation, Inc.

Zarkowsky, William Michael, B.Ae.E.; Power Plant Research Engineer, Aerodynamics Dept., Grumman Aircraft Engineering Corp.

Zemansky, Stanley Donald, B.S. in Ae.E.; Materials Manager, United Helicopters, Inc.

Zimmerman, Norman Herbert, B.S. in M.E.; Instructor in Applied Mechanics Dept., Washington University.

Zouck, Robert Linsley, Layout Designer, Structures Group, The Glenn L. Martin Co.

Elected to Associate Member Grade

Bell, John Francis, Major, Project Officer, Research Div., Air University.

Bell, William Thomas, Engineering Designer, Douglas Aircraft Co., Inc.

Berne, Richard, B.Ae.E.; Station Agent "A," United Air Lines, Inc.

Burroughs, William Dickson, B.S.; Service Engineer, Douglas Aircraft Co., Inc.

Chase, Joseph May, Supt. of General Inspection Section, Engineering Dept., Aero Insurance Underwriters.

da Costa, Oscar, Group Leader, Production Planning Dept. for Hydraulics, Canadair Ltd. (Canada).

Dickinson, John Lovewell, A.B.; Chief Engineer, Cal-Aero Technical Institute.

Echevarria, Albert, Layout and Pictorial Draftsman, Republic Aviation Corp.

Ferguson, Lachlon Grant, Flight Controls Engineer, Republic Aviation Corp.

Fitzpatrick, Arthur Matthew, Consultant, Industrial Designer, Fitzpatrick-Randall Associates.

Fleishman, Louis John, Flight Engineer, Pan American World Airways, Inc.

Griffin, Bradford John, Project Weight Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

Marcus, Raphael A., Service Engineer, Canadair Ltd. (Canada).

Napier, Bernard Andrew, B.S. in Ae.E.; Liaison Engineer, Boeing Aircraft Co.

Neace, John Forrest, Field Manager (Crop Dusting Div.), Marsh Aviation Co.

Pack, Josiah G., Supervisor, Field Service, S.E. Territory, Douglas Aircraft Co., Inc.

Perl, John, Ph.D.; Research Lab. Analyst, Lockheed Aircraft Corp.

Pond, LeRoy Yates, Act. Leadmechanic, Engine Test Stands, American Airlines System.

Robinson, Arnold Paul.

Seebol, Robert Leon, Owner, Design & Development Consulting Firm, Robert L. Seebol Associates.

Wright, Harry Dudley, Sales Engineer, G. M. Giannini & Co.

Elected to Technical Member Grade

Anderson, Warren Edward, B.S. in Ae.E.; Jr. Engineer (Structural Test), Boeing Aircraft Co.

Benneche, Robert Andrew, B.Ae.E.; Aerodynamicist, Development Engineering, Consolidated Vultee Aircraft Corp.

Brame, Frank H., Sr. Design Draftsman, A. V. Roe (Canada) Ltd.

Capelouto, Isaac, B.S. in Ae.E.; Jr. Aerodynamicist, Wind Tunnel Group, McDonnell Aircraft Corp.

Glaser, Jack, Design Engineer, Guided Missiles, Pilotless Plane Div., Fairchild Engine & Airplane Corp.

Jack, Stephen, B.S. in Ae.E.; Jr. Engineer, Wright Aeronautical Corp.

Jones, James Bernard, Engineering Draftsman, Piasecki Helicopter Corp.

Lecavalier, Robert, B.A.Sc.; Aerodynamic Engineer, A. V. Roe (Canada) Ltd.

Loney, John Ogden, Group Leader, International Aviation Corp.

Main, Guy F., B.S. in C.E.; Stress Analyst "B," Consolidated Vultee Aircraft Corp.

Noble, Rodney, B.E. in Ae.E.; Planning & Performance Engineer, Trans-Australia Airlines (Australia).

Sofen, Irving Arnold, B.S.E.E.; Electronic Engineer, Bell Aircraft Corp.

Tobey, Harry, B.Sc. in M.E.; Stress Analyst, Piasecki Helicopter Corp.

Ulm, Richard Henry, Layout Draftsman and Jr. Designer, Goodyear Aircraft Corp.

Ulrich, Benjamin Harrison, Jr., B.S. in Ae.E.; Aero. Engineer, Langley Mem. Aero. Lab., N.A.C.A.

Yorke, Roy Edward, B.S. in Ae.E.; Sr. Design Draftsman, The Glenn L. Martin Co.

Zimmerman, Richard Horst, M.Sc.; Instructor, Dept. of Mechanical Engineering, Ohio State University.

Transferred from Student to Technical Member

Anderson, Arnold Windsor, B.S. in Ae.E.; Asst. Project Engineer, David Taylor Model Basin (Washington, D.C.).

Armstrong, Forrest Eldridge, B.S.; Designer, Consolidated Vultee Aircraft Corp.

Barker, Richard Sheldon, B.S. in M.E.; Stress Analyst, Hamilton Standard Propellers Div., United Aircraft Corp.

leading aircraft instruments —by the *instrument leader!*

Model 888

Weston *Cross-Pointer Indicator* (ID-48)

—used with Instrument Landing Systems

Weston *Trim Indicators* (O-1)

—used for *visual indications* with Automatic Pilots

Model 883

Weston *Free Air Thermometers*

—featuring the new flush mounting Resistance Bulb

FOR ADDITIONAL INFORMATION write Weston Electrical Instrument Corporation, 616 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON *Instruments*

ALBANY · ATLANTA · BOSTON · BUFFALO · CHARLOTTE · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · JACKSONVILLE · KNOXVILLE · LITTLE ROCK · LOS ANGELES · MERIDEN · MINNEAPOLIS · NEWARK
NEW ORLEANS · NEW YORK · PHILADELPHIA · PHOENIX · PITTSBURGH · ROCHESTER · SAN FRANCISCO · SEATTLE · ST. LOUIS · SYRACUSE · IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

Boyd, Donald Vernon, B.S.; Draftsman, Brown Shipbuilding Co.

Brown, Kenneth Lee, B.S.; Research Engineer, McDonnell Aircraft Corp.

Bryant, Oren Wayne, Engineering Draftsman "A," Douglas Aircraft Co., Inc. (El Segundo Plant).

Bryson, Arthur Earl, Jr., B.S. in Ae.E.; Graduate Fellow in Mathematics & Physics, Iowa State College.

Corchado, Fernando, Ae.E.

D'Aprile, Vincent Anthony, B.Ae.E.

Davidson, Bernhard Frederick, B.Ae.E.; Engineer—Sales, Davidson Electric Co.

Demchak, Albert Hugo.

DeVita, Albert Nicholas, Design Engineer, The Glenn L. Martin Co.

Di Mauro, Joseph.

Doughty, Kenneth Virgil, B.S. in M.E. (Aero.); Engineering Draftsman "B," Consolidated Vultee Aircraft Corp.

Dudek, Edward Frank, Jr., B.S.; Research Engineer, United Aircraft Corp.

Gannett, James Russell, B.S. in Ae.E.; Research Asst., Research Center, University of Michigan.

Gipe, Jack Ross, B.S. in Ae.E.; Engineering Draftsman, The Glenn L. Martin Co.

Goldman, Jerome Marvin, B.S. in Ae.E.; Flight Supervisor, Purdue University Airport.

Ham, Edward Henry, B.S. in M.E.; Engineer in Aerodynamics Group, McDonnell Aircraft Corp.

Holliday, Paul Trebel, B.S. in Ae.E.; Mathematician, Douglas Aircraft Co., Inc.

Houchens, Walter Byron, B.S. in Ae.E.

Hunt, Raymond Sailors, Jr., B.Sc. in Ae.E.; Engineering Asst. (A), Trainee, Consolidated Vultee Aircraft Corp.

Islinger, Joseph Stephan, B.S. in Ae.E.; Asst. Research Engineer, McDonnell Aircraft Corp.

King, Jesse James, Jr., B.S.; "A" Draftsman, Douglas Aircraft Co., Inc.

Kowalski, Adolf Ernest, B.Sc.; Instructor in Mathematics, Spartan School of Aeronautics.

Lalos, George T., Ensign, U.S. Navy.

Lalvani, Shersing Jethmal, B.S. in Ae.E.; Field Representative, Amer Ind Inc.

Liebhauser, Margaret Jeanne, Miss.

Loewy, Robert Gustav, B.Ae.E.; Graduate Student, M.I.T.

Maxwell, Norman Edgar, B.S.; Aerodynamicist "B," Consolidated Vultee Aircraft Corp.

Melton, Donald Franklin, B.S.; Research Engineer, General Mills Inc.

Merrill, Ralph Lucas, B.Sc. in Ae E.; Engineering Draftsman, Douglas Aircraft Co., Inc. (El Segundo Plant).

Mickleboro, Harry Cecil, Jr., B.S.; Engineer P-1, Langley Mem. Aero. Lab., N.A.C.A.

Parzel, Alphonse Stanley, Ae.E.; Draftsman, The Glenn L. Martin Co.

Petters, James Richard, B.Ae.E.; Ensign, Supply & Disbursing Officer, U.S.-N.R.

Reider, Warren Alfred, Student, Newark College of Engineering.

Rhodes, John McCray, B.S. in Ae.E.; Jr. Engineer, Aviation Gas Turbine Div., Westinghouse Electric Corp.

Roden, William Stephen, B.S.; Aero. Engineer (Grade P-1), Langley Mem. Aero. Lab., N.A.C.A.

Schoonover, Thomas Harrison, B.S.; Graduate Asst., Wayne University.

Seeger, Charles Harry, B.S. in Ae.E.

Silverblatt, Bernard Louis, B.S. in M.E.; Aero. Engineer, Curtiss-Wright Corp. (Columbus Plant).

Stokka, Oscar Richard, B.S.; Asst. Research Engineer, McDonnell Aircraft Corp.

Streicher, Albert Henry, B.S. in Ae.E.; Jr. Stress Analyst, The Glenn L. Martin Co.

Stucker, Harry T., B.Sc.; Graduate Student, Kansas University.

Wackelin, Harold Leander, B.S. in Ae.E.; Instructor, Aeronautical University.

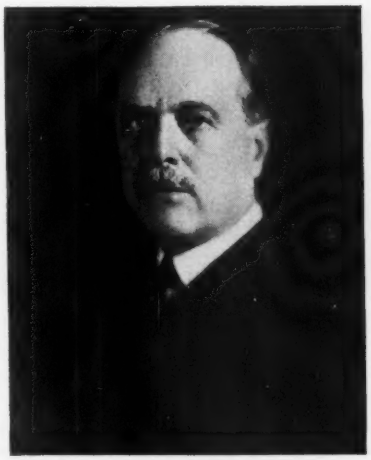
Washburn, John Edward, B.S. in Ae.E.; Student (Management Engineering), A. & M. College of Texas.

Necrology

Samuel Stewart Bradley

Samuel S. Bradley, Chairman of the Board of the Manufacturers Aircraft Association, aviation pioneer, and one of the original incorporators of the Institute, died April 9 at his home in New York. For more than 40 years he had been a leader in the business and civic life of New York. It was in aviation, however, that he attained his greatest prominence, and his achievements in that field made him one of the best-known figures in aeronautics throughout the world.

Mr. Bradley was born in Medina, Ohio, on June 27, 1869. He was president of the Patterson, Gottfried and Hunter Company, one of the country's largest hardware firms, as well as a director of many corporations. While serving on a number of war committees in 1917 he was drafted by the Government and the aircraft manufacturers to head the Manufacturers Aircraft Association to stimulate production of military aircraft for the American offensive on the western front.



Samuel Stewart Bradley.

With war production geared to maximum output in 1918 and with the end of hostilities in sight, Mr. Bradley went to Washington and convinced the Government officials of the need for launching a program for the development of commercial aviation immediately after the German surrender. From then on until the end of World War II, he devoted his efforts to the development of American aviation, both military and commercial, as our greatest and most powerful insurance of national security.

In 1919, President Wilson named him Secretary of the American Aviation Mission to Europe. The report of this Mission formed the basis of a national aviation policy that encouraged the growth of a healthy aircraft manufacturing industry and trained air forces and culminated in the decisive victories of our American air power in World War II. In 1920 he organized the Aeronautical Chamber of Commerce, now the Aircraft Industries Association of America. He organized a nation-wide committee of businessmen to adopt air mail in business correspondence and worked with the Government in establishing the first air-mail service between New York and San Francisco.

In 1924 he organized a committee that worked with former President Herbert Hoover, then Secretary of Commerce, in drafting provisions for the first national air law, which was passed in 1926 and which forms the basis for all present laws regulating commercial aviation.

THUNDERJET—Republic's P-84 jet fighter which is now in active production for A.A.F. Squadrons. *(Official U.S. Army Air Forces Photograph)*

Editorial

AD ASTRA (Third Movement, Prelude)

Since the day in December of 1903 when man first tried his wings, the development of aviation has passed through two distinct phases—two movements, if you like—in a great aerodynamic symphony whose finale is yet too far in the future to be anticipated, even in dimmest outline.

The First Movement opened *pianissimo*. In the first decade of the Twentieth Century, the Wrights and a few others learned to fly, but few people were much impressed. ("If God had intended man to fly, He would have given him wings!") With World War I, however, the tempo became *accelerando*, and through the Nineteen Twenties the music swelled in pitch and in intensity as the Theme of the Stick-and-Wire Airplane was fully developed. Climax came with the Lindbergh Solo, after which a marked *andante* phase set in, a slowing down of the pace as the type approached the limit of its capabilities.

A blare of trumpets opened Part II, announcing a new theme—the concept of the "modern" airplane, born of scientific research, streamlined from nose to tail. Again the tempo quickened. Again, performance advanced from peak to peak. Throughout the Thirties *crescendo* followed *crescendo*, ending in a terrifying discord—the cacophony of World War II.

Through the noise and confusion of that *finale*, however, acute listeners could again detect a slowing down of pace. The theme, announced so bravely as the movement opened, was wearing thin. Once again the airplane was approaching the limit of its capability. As its speed and performance increased, new problems rose to plague the aeronautical engineer and the aeronautical scientist. Natural phenomena imposed ceilings that said, "thus far, and no further."

But again, a challenge has been met. The engineer refused to recognize the limitation and cast about for a way to break through. So, under the drumming of a million exhaust stacks which heralds the climax of the Second Movement, a new note can be heard—a sustained blending of brasses and tympani, like the roaring of a mighty wind, the Voice of the Jet that announces the new theme for Part III of our Aerial Symphony.

So far, only the Prelude is recognizable. Those of us who attended the Cleveland Propulsion Meeting last month came away with a feeling that, although much has been accomplished, only one short step has been taken on the long road ahead. To revert to our musical analogy, we realize that only the first few notes of the new theme have been written down. Many years of toil and travail lie ahead before the full symphonic structure for the Third Movement will be complete.

We know, however, that we have in our hands the tools to complete that structure. The jet and rocket engines, embryonic as they are now, will open the way to future aircraft performance undreamed of today.

How far we can go and how soon we can get there depend almost wholly on the energy and the degree of intelligence that can be brought to bear by the aeronautical engineering profession. The problem is so big and so complex that no individual or independent group can hope to solve it single-handed. Coordinated, cooperative action alone can do the job. But it must be intelligently planned and carefully executed. That is where the I.A.S. has a clear-cut responsibility. The membership of the Institute, assembling as it did at Cleveland for joint discussion on the critical subject of propulsion for tomorrow's aircraft, must assume the role of composer in the writing of the score for the next movement in the symphony of Man's march toward the stars.

S.P.J.

Cleveland Confab

Symposium and Extemporaneous Discussions Highlight National Aircraft Propulsion Meeting

ALTHOUGH JET PROPULSION PROGRESS has been three to five times faster than reciprocating engine improvements over a comparable period, the further development of these new types of power plants still requires extensive and intensive research in the fields of metallurgy, aero-, and thermodynamics.

This was the challenge accepted by more than 500 engineers attending the second annual Aircraft Propulsion Meeting of the Institute held in the Hotel Carter in Cleveland. The Cleveland Section of the Institute acted as host to the many members and guests from out of town. Special thanks are due to George Scragg, Chairman of the Section, and Richard C. Gazley, Secretary, for handling meeting arrangements.

The one-day meeting included 14 papers. Highlight was an N.A.C.A. Symposium of six reports analyzing both the subsonic and supersonic speed ranges. Despite the tight schedule, the time for discussion on all papers was generous, and the extemporaneous questions and suggestions showed not only the high level of the papers but the interest they developed.

The success of the technical sessions is credited to the careful planning of Willson Hunter, in Charge of the Refrigeration Section at the Engine Research Laboratory; Abe Silverstein, Chief, Wind Tunnel and Flight Division; and A. M. Rothrock, Chief of Research, Cleveland Laboratory, N.A.C.A., all members of the Cleveland Section of the Institute. The symposium was planned by Abe Silverstein, Benjamin Pinkel, and A. M. Rothrock, who acted as Chairman. The feeling of those attending the meeting was expressed by one member who stated from the floor at the close of the meeting that it was "one of the best engineering meetings ever held."

The development of the gas turbine was accelerated during the war because of its suitability for power in jet-propelled aircraft and guided missiles. The real advent of the aircraft gas turbine might have come years earlier, however, except for several limiting factors. Several of these problems were discussed in the papers presented in the morning and afternoon sessions. A. T. Colwell, Vice-President, Thompson Products, Inc., and Arthur Nutt, Director of Aircraft Engineering, Packard Motor Car Company, acted as chairmen of these sessions, respectively.

Dr. J. W. Freeman, of the University of Michigan, started the meeting by discussing the metallurgical requirements for heat-resisting alloys for turbine discs and blades, stator blades, liners for combustion chambers, and tail-pipe assemblies. He outlined the remarkable progress that has been recently made in high-temperature metallurgy, but he stressed the need for additional research and concluded his remarks with a discussion of the future prospects of improved materials for jet engines.

The modern liquid-fuel rocket motor is a truly remarkable propulsion device. In no other mechanism, with the exception of the atom bomb, is such a large quantity of energy released per unit of time and per unit of volume. One of the most difficult problems in designing a rocket motor is to build a combustion chamber and nozzle capable of handling this tremendous rate of heat release. T. F. Reinhardt, of the Bell Aircraft Corporation, in his paper "Regenerative Rocket Cooling," stated that "the rocket combustion chamber may have to withstand pressures of 20 to 60 atmospheres and temperatures of 4,000° to 6,000°F., and the nozzle may have to withstand these temperatures in combination with velocities up to 8,000 ft. per sec. It may be possible to find materials that will withstand these temperatures; and, in fact, many successful short-duration rockets have been built with no cooling other than their own capacity for absorbing heat. However, when we

Second Annual Aircraft Propulsion Meeting

start to consider rocket motors for long-period continuous operation, cooling becomes an absolute requirement; for even if we could find materials to withstand the temperatures, the rocket motor would soon get so hot that it would melt the motor mountings and set fire to the aircraft. We, therefore, want a cooling system that will absorb the heat before it gets beyond the walls of the rocket motor and then continuously expel it from the aircraft. The obvious solution to this problem is to use one of the rocket propellants as the cooling medium."

Mr. Reinhardt, in his discussion, presented a method for calculating cooling requirements of rockets, giving estimates of heat-transfer coefficients on gas and liquid sides of rocket walls, with alcohol-liquid oxygen propellant systems. He stated that the analysis of regenerative rocket cooling as presented had some shortcomings, the most serious being the lack of information on gas film coefficients, liquid film coefficients, and thermal conductivities. By making conservative guesses in each case, Mr. Reinhardt stated that we can be relatively certain that the rocket will cool properly and that by using this method rockets can be built which will operate continuously without burnout. In the discussion period the author stated that he believed the development of new rocket fuels was a more pressing problem than metallurgical developments and that the creation of a fuel that would bring rocket consumption down to some five times that of turbojets would make the two systems competitive.

Dr. A. J. Blackwood, Esso Laboratories, Standard Oil Development Company, in a paper entitled, "Aviation Gas Turbine Fuels," discussed the effect of individual specification items on both the performance and availability of gas turbine fuels. It was pointed out that, while peacetime requirements would not be critical, the availability of jet fuels meeting the current kerosene type AN-F-32 and AN-F-34 specifications would be insufficient to meet emergency demands. The significance of individual specification items was discussed, and Dr. Blackwood described in detail the two alternate types of fuel specifications presently being considered by the N.A.C.A. In conclusion he stated that prototype fuels should be evaluated both in the laboratory and in the field, since the potential availability of these fuels would exceed emergency demands.

A. T. Colwell.

Arthur Nutt.

An experimental method of designing high-performance axial-flow compressor blades, which is calculated to reduce by at least 50 per cent the number of stages necessary in axial-flow compressors, was presented by S. M. Bogdonoff, formerly of the Langley Laboratory, N.A.C.A., and now on leave at Princeton University. Mr. Bogdonoff stated that for the last 3 years the N.A.C.A. has been working on a program to develop axial-

flow compressor blading to give considerably higher pressure rises per stage than those now obtained in commercial compressors and at the same time to give very high efficiencies. Low-speed and high-speed two-dimensional cascade tunnels and a low-speed test blower were used. Typical sets of curves which give the two-dimensional design data, the efficiency variations with loading, and the critical speed of blade sections were presented based on the results received from the series of tests made. In his concluding remarks the author stated: "The low-speed and high-speed cascade tunnels and the low-speed test blower have provided the basis for an experimental method of designing axial-flow compressor blades. In these apparatus the important parameters involved in compressor blade design, turning angles or loading, design angle of attack, and qualitative critical speed have been evaluated. The results obtained showed that: (1) The low-speed rotor and high-speed cascade tests verify the assumptions that formed the basis for the design method based on low-speed cascade tests. (2) The turning angles, found from low-speed cascade tests, vary less than 1 degree for all Mach Numbers below the force break. (3) Maximum efficiency was obtained at the design conditions, and these conditions do not appear to change with Mach Number. (4) Blades designed from these data have high efficiency and wide operating range, even for blades loaded much higher than those now in use. (5) The critical Mach Number must be definitely exceeded before the performance of a compressor blade changes radically, in a manner similar to the isolated airfoil at high Mach Numbers. Tests of this type give the much needed limiting conditions that establish the maximum pressure ratio or power input that can be obtained in a single stage of a compressor. With the loadings and Mach Numbers shown possible by these tests, performance comparable to the best existing axial-flow compressor could be obtained with half the number of stages."

Design of Aircraft Gas Turbine Components

Additional research is needed to improve the efficiency and reliability of high-performance compressors. There are many aerodynamic intricacies in centrifugal and axial-flow compressors still unsolved. The aerodynamic design aspects of the axial-flow compressor were discussed by Hunt Davis, Division Engineer, Elliott Company, in his paper "A New Method for the Aerodynamic Design of Multistage Axial-Flow Compressors." In his discussion he neglected the effect of Reynolds Number, aspect ratio, leakage, and secondary flow effects, but he discussed the derivations of an optimum inlet Mach Number for the first stages of an axial-flow compressor and presented a graphical method for making calculations of blade settings. It was shown that it is possible to use the same blading design for successive stages even though the stage loadings are not constant. In presenting his method he said that "frequently a compressor is designed in such a way that the blade form in every stage is different from all the other stages, thus requiring a different die for each blade row. It would be quite advantageous economically to be able to use the same blade design in several stages without compromising the desired load distribution between stages and without violating the laws of free vortex flow. It can be shown that such a design is possible for both rotor and stator blades, assuming that the only difference in blading between several successive stages is a reduction in length obtained by cutting off the free end and different angle setting of the blade in the root fastening."

A great increase in activity in the aircraft gas turbine field in recent years has focused attention on problems associated with the attainment of very high efficiency of the various turbine components. Since design work is progressing at such a rapid rate, John E. Talbert and J. C. Smith, of the Wright Aeronautical Corporation, felt that it would be helpful to make a summary of present knowledge and evaluate the progress thus far

POWER-PLANT SYMPOSIUM PANEL

This entire group from the N.A.C.A. Cleveland Laboratory covered the field of power-plant potentials.

obtained. Such a summary was presented in their paper "Aero-Thermodynamic Aspects of Aircraft Turbine Expansion Unit Design." Following a discussion of present-day design procedure, Mr. Talbert stated that there are many assumptions that still need to be accurately evaluated—namely: (1) analysis of the action of the boundary layer at the I.D. and O.D. of the blade annulus, as well as the action of the boundary layer on the blade itself; (2) the problem of obtaining high efficiency at high turning angles; (3) the problem of Reynolds Number or turbulence in the selection of blade chord length and shape; (4) the question of optimum incidence angle in a cascade of turbine blades; (5) the problem of selecting the optimum leaving velocity from the blade for a given relative inlet velocity or Mach Number; (6) the problem of deviation of the air from the actual blade angles, especially at the exit when designing a blade and passage (the engineers need to know more about the flow pattern that dictates this deviation); and (7) the problem of blade vibration and damping resulting from aerodynamic forces.

Dr. William R. Hawthorne, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology, in his paper "Design of Combustion Chambers for Gas Turbines," stated that combustion chambers for gas turbines are developed rather than designed. As the general arrangement of the engine is influenced by the overall arrangement and external dimensions of the combustion system, these factors must be determined early in the design of the engine. Dr. Hawthorne presented a method for determining the influence of combustion-chamber dimensions on engine performance. It was shown that the pressure and unburned losses are related to the combustion intensity and a pressure loss factor. The loss of power or thrust and the gain in specific fuel consumption are then related to the dimensions of the system. As the size of the combustion chamber assembly controls the frontal area of the engine, Dr. Hawthorne suggested that the annular combustion chamber warrants further development, since it is the smallest.

The control of propulsive powers is of vital importance in obtaining best aircraft performance. That the aircraft gas turbine presents compact control problems because of the wide range of ambient and flight conditions that require automatic compensation was brought out by Dr. M. A. Edwards, Assistant Engineer, Control Systems Division, and J. D. Thompson, Aeronautics and Marine Engineering Division, General Electric Company, in their paper "Control of Aircraft Gas Turbines." It was shown that wide variations in ram air pressure (air speed), ambient temperature, turbine speed, and altitude must be controlled to provide optimum performance and reliability. Dr. Edwards remarked that the control system should have the following functional features: (1) Provide a definite fraction of maximum available thrust for every given throttle setting. This involves automatic compensation for ambient conditions. (2) Make maximum range of thrust available with due regard for safety, involving overspeed and overtemperature protection. (3) Provide for maximum rates of change of thrust. This may involve integral control of variable jet nozzle area and propeller pitch on prop-jet engines. (4) Recognize operating limits of compression and combustion to (a) prevent compressor stall due to too rapid acceleration and (b) prevent burner blowout due to too rich or too lean fuel-air ratios, as during starts, decelerations, and idling conditions. (5) Provide emergency protection; (a) controls should fail safe or have manual override; (b) emergency fuel system should be available to cut in automatically when needed; (c) automatic ignition should be available. (6) Be simple to operate; (a) single lever control with no limitations on movement of lever through total travel; (b) automatic compensation of all variables; (c) automatically controlled starting, acceleration, and idling adjustment.

(*Continued on page 69*)

Left to right **(across both pages): E. Bernardo, G. F. Kinghorn, B. T. Lundin, A. M. Rothrock, Chairman, N. D. Sanders, J. C. Sanders, and E. J. Manganiello.**

I.A.S. Briefs

Summaries of current papers received for publication or presentation at I. A. S. meetings

This Section, started in the January, 1947, issue of the REVIEW, *has been established to give advance and current information on papers presented to the Institute for publication or for presentation at meetings. Summaries of all pertinent papers, including those given at Section and Student Branch meetings, will be published each month in these columns as rapidly as they are received from authors.*

Many of these papers, after being processed by the Editorial Committee in the usual manner, will appear in full in later issues of the JOURNAL *or* REVIEW. *Preprints of some papers are immediately available, or will become available at an early date, at a price of 25 cents each (to cover handling costs) to I.A.S. members, and 75 cents each to nonmembers. Requests for preprints should be addressed to Editorial Department, Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.*

Preboiling Evaporation Losses in Aircraft Fuel Tanks

By

L. M. Whitney, F. G. Bollo, and A. G. Cattaneo

Shell Development Company

In view of increasing interest in methods by which fuel evaporation losses can be predicted for long-range cruising flights at below boiling altitudes, a set of equations was derived by which the losses at altitudes lower than the boiling altitude may be calculated from known initial fuel characteristics and known flight and tank conditions.

The variables that affect these losses can be classified as fuel characteristics and temperature, altitude pressure, and tank and flight conditions. Some assumptions were necessary to derive the equations and to simplify them for practical use.

There are three main causes of evaporation losses: tank breathing, air sweeping through the tank, and air evolving from the fuel. Equations were derived to determine the losses for each of these. Companion equations, needed to complete the solutions, were derived for the change in fuel vapor pressure resulting from fuel evaporation and its effect on temperature. The effect of evaporation on vapor pressure was determined experimentally using a vapor pressure apparatus more sensitive than that used in the Reid method. For the temperature effect, an equation already determined by others was used.

In practice, losses may vary in a single climb from less than 1 per cent to as high as 2 per cent, to which tank breathing contributes the greater part for tanks more than 15 per cent empty. If air sweeping is possible, the losses increase with the length of the flight.

Determination of Turbojet Engine Thrust from Tailpipe Measurements

By

Raymond W. Pyle

The Ryan Aeronautical Company

The engine rating curves furnished by the manufacturer of turbojet engines are usually not satisfactory for determination of the thrust produced by a particular engine in a particular airplane. These curves do not take into account the effects of exhaust nozzle size, tailpipe losses, and, in some cases, inlet pressure ratios. For these reasons, it has been found to be more satisfactory to determine thrust from instrumentation in the jet tailpipe or exhaust nozzle.

A simplified procedure for the determination of jet engine thrust and airflow has been developed to aid in the reduction of data obtained by tailpipe or nozzle instrumentation. Equations are derived from which working curves may be plotted to show clearly the effect of changes in any variable. These curves are especially useful in flight-test data reduction.

Aerothermodynamic Aspects of Aircraft Turbine Expansion Unit Design*

By

Josh E. Talbert and J. C. Smith

Wright Aeronautical Corporation

The great increase in activity in the aircraft gas-turbine field in recent years has focused attention on problems associated with the attainment of very high efficiency of the various turbine components. The expansion or turbine component has had its share of attention from many research and

development engineers. Since design work is progressing at such a rapid rate, it is felt that it would be helpful to all concerned to pause at various points in the progress to summarize present knowledge, evaluate the progress thus far obtained, and enumerate the problems still confronting us. In this paper, the writers have tried to present their views of such a summary.

* Paper presented at the National Aircraft Propulsion Meeting, I.A.S., Cleveland, March 28, 1947, by Josh E. Talbert.

Control of Aircraft Gas Turbines*

By
M. A. Edwards and J. D. Thompson
General Electric Company

The operation of aircraft gas turbines involves many factors requiring automatic compensation, such as wide variations in ram pressure, temperature, turbine speed and altitude, together with other variables that must be satisfactorily controlled to give optimum performance and reliability for this type power plant. The control system must make available the maximum range and rates of change of thrust, at the same time safeguarding continuous stable operation of the turbine and compressor. The control of jet nozzle area and propeller pitch are important factors in this respect.

Many types of control systems have been studied and worked with, the system discussed here being the outgrowth of these developments. This is basically a speed-controlling system rather than solely a fuel control for the turbojet power plants, while for the propeller-type units it is primarily a thrust-controlling system at constant speed. Several of the devices used in one form of such control systems are briefly described.

* Paper presented at the National Aircraft Propulsion Meeting, I.A.S., Cleveland, March 28, 1947, by M. A. Edwards.

Design of Combustion Chambers for Gas Turbines

By
William R. Hawthorne
Massachusetts Institute of Technology

Combustion chambers for gas turbines are developed rather than designed. Early in the design of an engine, however, it is necessary to settle the overall arrangement and major external dimensions of the combustion system for these in turn influence the general arrangement of the engine. A method is presented for determining the influence of combustion chamber dimensions on the engine performance. The pressure and unburned losses are related to the combustion intensity and a pressure loss factor. The loss of power or thrust and the gain in specific fuel consumption are then related to the dimensions of the system.

In a typical turbojet engine of 6:1 pressure ratio, the size of the combustion chamber assembly controls the frontal area of the engine. The annular combustion chamber is the smallest and, on this score, warrants further development.

Heat-Resisting Alloys for Use in Jet Propulsion Engines*

By
J. W. Freeman
University of Michigan

The metallurgical requirements for heat-resisting alloys in jet propulsion engines, as they have been presented to the research metallurgists, are reviewed for the turbine discs and blades, stator blades, liners for combustion chamber, and tailpipe assemblies. The fundamental metallurgical principles controlling the properties of the alloys for the types of service are discussed. In so far as possible, from the results of research to date, generalizations of the effects of chemical composition, heat-treatment, and processing procedure are made. As a necessary part of these generalizations, additional research needs are outlined and some guesses made as to future prospects of improved materials for jet engines.

* Paper presented at the National Aircraft Propulsion Meeting, I.A.S., Cleveland, March 28, 1947.

Note on Stresses in a Wing or Fuselage with Buckled Skin

By
H. L. Langhaar
Consolidated Vultee Aircraft Corporation

This note presents a derivation of modifications that may be introduced into beam analyses of wings and fuselages to account for von Kármán effective widths of skin in areas where buckling occurs. The theory simplifies the usual procedure, since repeated approximations deal only with the buckled skin elements, and not with an entire cross section. Modified shearing stresses are derived explicitly.

Plan Now to Attend
Annual Summer Meeting
Los Angeles, Calif., Ambassador Hotel
August 7–8, 1947

Jatos mounted on underside of wings.

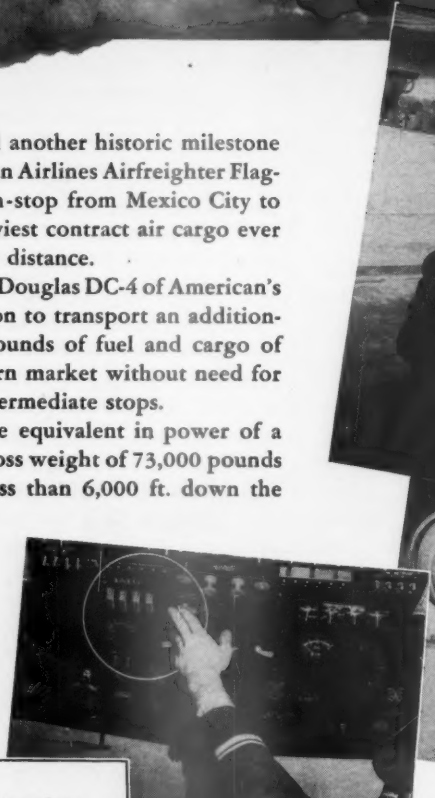
Another Aerojet "First..."

AMERICAN AIRLINES LAUNCHES RECORD-BREAKING CONTRACT CARGO FLIGHT!

Jet-assisted take-off passed another historic milestone recently when the American Airlines Airfreighter Flagship "St. Joseph" flew non-stop from Mexico City to Philadelphia with the heaviest contract air cargo ever carried on a flight of such distance.

Use of Jatos enabled the Douglas DC-4 of American's Contract Air Cargo Division to transport an additional useful load of 9,000 pounds of fuel and cargo of ripe bananas for the eastern market without need for time-consuming costly intermediate stops.

Four Aerojet Jatos — the equivalent in power of a fifth engine — aided the gross weight of 73,000 pounds to become airborne at less than 6,000 ft. down the runway of the 7300-feet-above-sea-level airport. As a result of the operation, American will make Aerojet Jato Motors immediately available on its Airfreighter fleet.



Jato controls, pilot's compartment.

Airline operators can now take immediate advantage of exclusive Aerojet benefits:

Greater take-off safety factors
Increased payloads
Bigger fuel reserve against adverse flying conditions
Reserve power for emergencies

Aerojet will be glad to answer questions concerning your own operation problems. Write today to Aerojet Engineering Corporation, Azusa, California.

The Aerojet Jato Motor Carries C. A. A. Rocket Motor Certificate No. R-1.

Aerojet

PACKAGED HORSEPOWER

AEROJET ENGINEERING CORPORATION • AZUSA, CALIF. • SUBSIDIARY OF THE GENERAL TIRE & RUBBER CO.

Aeronautical Reviews

Aerodynamics

Numerical-Graphical Methods of Characteristics for Plane Potential Shock-Free Flow Problems. Lester L. Cronvich. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 237–242, figs. 6 references.

The two methods developed from the basic theory of characteristics are restricted to plane potential shock-free flow. The "lattice-point" method, recommended for flows with given boundaries, is applied to flow in a hyperbolic channel. The "field" method, suitable for problems in which flow boundaries are to be determined, as in the case of supersonic nozzle design, is used for a problem of parallel routing of an initially expanded flow. Complete rules of procedure are presented for each method.

The Flow and Force Characteristics of Supersonic Airfoils at High Subsonic Speeds. W. F. Lindsey, Bernard N. Daley, and Milton D. Humphreys. *U.S., N.A.C.A., Technical Note No. 1211*, March, 1947. 55 pp., figs. 6 references.

An investigation was conducted at subsonic Mach Numbers in the Langley rectangular high-speed tunnel on five supersonic airfoils and on two subsonic airfoils. Two-dimensional data were obtained by pressure measurements and schlieren photographs at angles of attack from 0° to 4° for Mach Numbers between 0.30 and 0.90 for these 6-per-cent-thick symmetrical airfoils. The results indicated that the drag coefficients are generally higher at subsonic Mach Numbers for the supersonic airfoils than for the subsonic airfoils, but the normal force and pitching-moment characteristics of those supersonic airfoils having their maximum thickness located at the 0.7 chord station would diminish the problems generally encountered in longitudinal control at high Mach Numbers. An unusual flow phenomenon occurred at the leading edge of the supersonic airfoils at the higher Mach Numbers. This phenomenon, through the elimination of an extensive separated-flow condition over the forward part of the airfoil, effected a rather sudden increase in normal-force coefficient and, in some cases, a decrease in the drag coefficient.

On Supersonic and Partially Supersonic Flows. Stefan Bergman. *U.S., N.A.C.A., Technical Note No. 1096*, December, 1946. 85 pp., figs. 22 references.

By using the hodograph method (introduced in the theory of compressible fluids by Chaplygin) a formula had previously been obtained for the stream function of a possible subsonic compressible flow in terms of an arbitrary analytic function of a complex variable; procedures for using some methods and techniques of the theory of analytic functions in the theory of subsonic flows have likewise been indicated and, as a consequence, new flow patterns have been obtained. These flow patterns include examples of flows around symmetric and nonsymmetric obstacles, under the assumption of the true pressure-density relation. The foregoing results are improved and completed. A formula (analogous to that for subsonic flows) is derived, which represents a stream function of a possible supersonic flow in terms of two arbitrary differentiable functions of one real variable. Some instances are discussed in which flow pattern defined in two neighboring parts of the plane can be combined into one flow pattern defined in the combined domain. This last method leads, in some instances, to partially supersonic flows.

The Formation and Stability of Normal Shock Waves in Channel Flows. Arthur Kantrowitz. *U.S., N.A.C.A., Technical Note No. 1225*, March, 1947. 51 pp., figs. 2 references.

An analysis of nonviscous, unsteady, channel flow was made to gain some insight into the apparent instability of channel flows involving shock-free deceleration through the speed of sound; to provide some information concerning the minimum shock intensity for a stable flow; and to study in general the formation and motion of shocks in channel flows. Riemann's theory of the propagation of finite-amplitude disturbances in a homogeneous medium is extended to the case where upstream-moving pulses are superposed on a decelerating transonic channel flow. Shock waves are formed as the pulse is propagated, as in Riemann's problem. The pulse approaches a "trapped" state, in which a portion of the decelerating channel flow is converted to an accelerating flow which is an alternate steady-state solution for the channel. Within the limitations of accuracy of the theory, the trapped pulse becomes stationary in the sonic region of the channel, and thus the flow has neutral stability. The assumption of weak shocks is dropped and the motion of shock waves is considered more accurately. It is found that trapped expansion pulses are consumed by the shock motion, and trapped compression pulses inevitably grow. Therefore, smooth transonic deceleration is unstable to compression pulses coming from the rear of the channel.

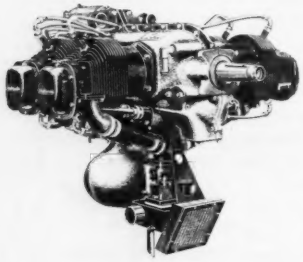
INDEX

Aerodynamics..... 29
Air Laws and Regulations..... 32
Air Transport—General..... 32
Air Transport, Cargo..... 32
Air Transport, Scheduled..... 33
Airplane Descriptions..... 33
Airplane Design..... 33
Airports and Airfields..... 35
Airways and Traffic Control.... 35
Atomic Energy..... 35
Business and Finance..... 35
Control Systems..... 36
Electrical Equipment..... 36
Engine Parts and Accessories... 36
Engines—General..... 39
Engines, Gas Turbine..... 39
Engines, Ram-Jet..... 41
Engines, Reciprocating..... 41
Engines, Rocket..... 42
Flight Technique..... 42
Flight Testing and Performance.. 42
Fuels..... 43
Gliding and Soaring..... 43
Guided Missiles..... 45
Hydraulic Equipment..... 45
Ice Prevention..... 45
Instruments—General..... 45
Instruments, Engine..... 45
Instruments, Flight..... 45
Instruments, Meteorological.... 47
Insurance, Safety, and Rescue... 47
Landing Gear..... 47
Lubrication and Lubricants..... 47
Maintenance..... 47
Materials—General..... 48
Materials—Metals and Alloys.. 48
Materials—Plastics and Plywood 49
Materials—Protective Coating.. 50
Medicine..... 50
Meteorology..... 51
Military Aviation..... 51
Navigation..... 51
Parachutes..... 51
Production—General..... 53
Production Methods..... 53
Production Tools and Equipment 53
Propellers..... 53
Radio..... 53
Research..... 54
Rotating Wing Aircraft..... 54
Seaplanes and Flying Boats..... 55
Stress Analysis and Structures... 55
Wind Tunnels and Laboratories. 57

POWER BY
Red Seal
Engines
CONTINENTAL

Continental Red Seal Engines Power More Personal Planes Than All Other Engines Combined

From the standpoint of volume, as well as from that of quality, Continental Motors leadership in the personal plane engine field stands today at an all-time high. Continental Red Seal engines power more personal aircraft than all other engines combined. The overwhelming preference reflected in such leadership is the best of all possible reasons for specifying Red Seal power.



C85. *This 4-cylinder 85 h.p. engine is a post-war addition to the Continental line. It delivers its full rated horsepower at moderate engine speed, so that maximum propeller efficiency is attained. Low r.p.m. in relation to power is a characteristic of all Continental aircraft engines.*

Continental Motors Corporation
AIRCRAFT ENGINE DIVISION • MUSKEGON, MICHIGAN

Streamlines for the Subsonic Flow of a Compressible Fluid Past a Sphere. E. R. Van Driest. *Journal of Applied Physics*, Vol. 18, No. 2, February, 1947, pp. 194–198, fig. 4 references.

The second approximation to the velocity potential for the irrotational flow of a compressible fluid past a sphere, derived independently by Tamada and Kaplan, is used to calculate the subsonic streamlines for the flow of air at a Mach Number of 0.5 past a sphere. Comparison is made between these streamlines and those for the irrotational flow of an incompressible fluid. Velocity and pressure comparisons also are made.

Numerical Evaluation of the Rayleigh Method for Two-Dimensional and Axially-Symmetrical Three-Dimensional Flows in Compressible Media. Professor Sauer. (*Karlsruhe, Technische Hochschule.*) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2572.* 12 pp., diagrs. 4 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.60.

In order to obtain some bases of comparison and to facilitate the employment of computers without special mathematical training the scheme has been extended so far that no subjective freedom (e.g., in graphical differentiations, etc.) remains and only elementary operations with the calculating machine have to be carried out. Apart from approximation, by double sums of the double integrals, it contains no simplifying operations. Using a previously prepared table of influence factors, the method can be applied both to two-dimensional flows past profiles and to axially symmetrical, three-dimensional flows past solids of revolution. As a first approximation, use may be made of the incompressible flow or the Prandtl affine transformation or any given measurement data.

On Subsonic Compressible Flows by a Method of Correspondence. I—Methods for Obtaining Subsonic Circulatory Compressible Flows About Two-Dimensional Bodies. Abe Gelbart. *U.S., N.A.C.A., Technical Note No. 1170,* March, 1947. 35 pp. 15 references.

By means of the general solutions of the hodograph equations for compressible fluids, certain solutions corresponding to solutions of the hodograph equations of an incompressible fluid are used to find flow patterns of compressible fluids. When the adiabatic equation of state is used, only a general method is outlined. The method appears to lead to the solution of the problem of subsonic flows with circulation around arbitrary bodies, as the method of Theodorsen does for incompressible fluids. For the linearized equation of state, the results obtained include some of the results of von Kármán and Tsien, as well as some of the recent results of Bers. The method can be used for flows with circulation as well as without circulation.

On a Graphical Method of Gas Dynamics. P. de Haller. (*Technische Rundschau Sulzer*, No. 1, 1945, pp. 6–24.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2555.* 24 pp., figs. 10 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $1.25.

The method is based on the general properties of hyperbolic partial differential equations and can be generalized to include other problems that also can be solved by the use of that class of equations. It is applied to the investigation of unsteady flows in a cylindric pipe, and is adapted to more complicated problems, such as supersonic flow with axial symmetry or unsteady flow in a duct with variable cross section. The mathematical treatment is explained in detail, with several examples. The pressure waves in the exhaust duct of an engine were investigated. The result is compared with piezoelectric measurements on a six-cylinder engine. The agreement is good at the beginning of the wave but the curves diverge appreciably in the later stages, because the presence of scavenge air and of ducts leading to other cylinders were not taken into account.

Application of the Analogy Between Water Flow with a Free Surface and Two-Dimensional Compressible Gas Flow. W. James Orlin, Norman J. Lindner, and Jack G. Bitterly. *U.S., N.A.C.A., Technical Note No. 1185,* February, 1947. 64 pp., illus. 9 references.

The limitations and conditions of the analogy are discussed. A test was run using the hydraulic analogy as applied to the flow about circular cylinders of various diameters at subsonic velocities extending into the supercritical range. Reasonably satisfactory agreement of pressure distributions and flow fields existed between water and airflow about corresponding bodies.

Infinitesimal Conical Supersonic Flow. Adolf Busemann. (*Deutsche Akademie der Luftfahrtforschung, Jahrbuch, 1942–43,*

p. 455–470.) *U.S., N.A.C.A., Technical Memorandum No. 1100*, March, 1947. 16 pp., figs.

The method of calculation is limited more definitely to the conical case, but it is more convenient because the solution is obtained by analytic functions. The fundamental recognition that the hyperbolic character is replaced by the elliptic leads to more thorough investigation of conical fields as special cases in supersonic flows. The elliptic character may be only apparent, for by notching an indentation into a cone the real hyperbolic character of the field of the flow downstream from the indentation becomes obvious. By tracing the flow to a point far behind the indentation, there will appear inside the Mach cone a reciprocal relation between every two rays which will gradually restore the conical course of the flow. Instead of trying to produce the final flow by an infinite succession of hyperbolic dependencies, it is more expedient to consider special elliptic singularities at the points of disturbance. The significance of the conical field is found in these relations; the infinitesimal case represents only a first approximation to it.

The Calculation of Compressible Flows with Local Regions of Supersonic Velocity. B. Göthert and K. H. Kawalki. (*ZWB/FB/1794*, August 7, 1943.) *U.S., N.A.C.A., Technical Memorandum No. 1114*, March, 1947. 20 pp., figs.

Starting from the flow at a large distance from the profile determined according to Prandtl's rule, this outer flow was continued to the sonic velocity boundary by means of a numerical method; the method of characteristics of Prandtl-Busemann was applied for continuation beyond that boundary. These calculations result finally in the contour of the profile in the region of supersonic velocity. It is demonstrated in an example that mixed subsonic-supersonic flows about two-dimensional bodies can be calculated where not only the transition from subsonic to supersonic but also the transition from supersonic to subsonic takes place continuously, that is, without pressure jump. The symmetry of the local area of supersonic velocity for mixed supersonic-subsonic flows may be enforced by the outer subsonic flow. Since, however, the outside subsonic flow in turn must be produced by the profile in the flow or by the local area of supersonic velocity, the assumption seems justified that often only an unstable symmetric flow can be produced by the outside subsonic flow; and this unstable symmetric flow will turn even at small disturbances into the unsymmetric case with compression shocks.

A Problem in the Propagation of Shock. Monroe H. Martin. *Quarterly of Applied Mathematics*, Vol. 4, No. 4, January, 1947, pp. 330–348.

A single problem in the rectilinear motion of a gas is considered: the subsequent behavior of a gas initially at rest if its initial density is a constant ρ_0 in the region $|x| < 1$ and a constant $\rho_2 < \rho_0$ in the region $|x| > 1$. The behavior of the gas is an idealization of the behavior of the atmosphere in an infinitely long right circular cylinder after an explosion within the cylinder.

The Propagation of a Spherical or a Cylindrical Wave of Finite Amplitude and the Production of Shock Waves. Yung-Huai Kuo. *Quarterly of Applied Mathematics*, Vol. 4, No. 4, January, 1947, pp. 349–360.

High-Speed Measurements on a Swept-Back Wing (Sweepback Angle $\phi = 35°$). B. Göthert. (*Lilienthal-Gesellschaft für Luftfahrtforschung, Bericht 156*, pp. 30–40.) *U.S., N.A.C.A., Technical Memorandum No. 1102*, March, 1947. 33 pp., figs. 5 references.

The curves of lift, moment, and drag were determined up to Mach Number 0.87, and were compared with those of a rectangular wing. Up to a Mach Number of 0.80 no disturbance in lift and moment curves was noticed for a small lift coefficient, while at higher lift coefficients the slope of the lift curve decreased and the moment curve broke strongly toward the tail-heavy direction. At Mach Numbers from 0.80 to 0.87 another disturbance was formed primarily in the moment curve, which in the region of small lift coefficients brought about a displacement of the neutral point in a stabilizing direction, whereas at higher lift coefficients the break already observed at smaller Mach Numbers in the stable direction remained. By other measurements of the total-head loss behind the wing and by schlieren pictures, an insight into the formation of the compression shock at high Mach Numbers was obtained.

Effect of Reflex Camber on the Aerodynamic Characteristics of a Highly Tapered Moderately Swept-Back Wing at Reynolds Numbers up to 8,000,000. D. William Conner. *U.S., N.A.C.A., Technical Note No. 1212*, March, 1947. 23 pp., figs. 4 references.

Two models were tested, one with symmetric airfoil sections and the other with the same basic thickness forms but with a reflex-cambered mean line. The results of these tests show the following effects of the reflex-cambered mean line: (1) the upper limit of the low-drag range was shifted from a lift coefficient of about 0.35 to about 0.65; (2) airplane trim was unaffected at zero lift but at low lift coefficients the neutral point was moved forward about 2 per cent of the mean aerodynamic chord, and at lift coefficients beyond the low-drag range the forward shift in the neutral point was more severe; (3) the wing stall was delayed, but, once started, progressed more rapidly; and (4) the maximum lift coefficient, if the wings were trimmed, would be slightly increased.

The Streamline Pattern in the Vicinity of an Oblique Airfoil. Charles E. Watkins. *U.S., N.A.C.A., Technical Note No. 1231*, March, 1947. 26 pp., illus. 3 references.

A method for calculating the streamline flow pattern of a nonviscous incompressible fluid about an oblique airfoil from the corresponding flow pattern about the airfoil in normal position is presented and illustrated with two examples. The method can be extended to account approximately for compressibility effects by applying the Prandtl-Glauert correction factor to the flow pattern that is normal to the leading edge of the airfoil. The method is expected to be useful in determining the shape of a fuselage or nacelle having a minimum of interference with the flow over a swept-back wing.

Pressure Distribution Measurements at High Speed and Oblique Incidence of Flow. A. Lippisch and W. Beuschausen. (*Messerschmitt A.-G., ZWB/FB/1669*, September 25, 1942.) *U.S., N.A.C.A., Technical Memorandum No. 1115*, March, 1947. 57 pp., figs. 5 references.

Measurements were made on a symmetric wing profile of 9 per cent thickness, at 0°, 20°, and 40° yaw, in the high-speed tunnel of the Luftfahrtforschungsanstalt, Braunschweig. Taking into account the known theoretic influence of yaw, a comparison of the measurements with each other is undertaken, which discloses certain systematic deviations between theory and measurement. The pressure-distribution measurements make possible a comprehensive insight into the flow phenomena which are produced by oblique flow incidence. The results confirm the beneficial effect of yaw in the high-velocity region.

Theoretical Supersonic Lift and Drag Characteristics of Symmetrical Wedge-Shape-Airfoil Sections as Affected by Sweepback Outside the Mach Cone. H. Reese Ivey and Edward N. Bowen, Jr. *U.S., N.A.C.A., Technical Note No. 1226*, March, 1947. 60 pp., figs. 6 references.

The results apply to those parts of the wing in two-dimensional flow and are not applicable to wings swept back within the Mach

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

cone of the center section. The results may also be applied to swept-forward wings if the angle of sweep is not enough to put the wing within the Mach cone from the tips.

Tests on the Drag Variation of a Wing, on Discharge of Heated Air. Schwier. (*Göttingen, Aerodynamische Versuchsanstalt, ZWB/FB/Re/1783*, March 15, 1943.) *U.S., Army Air Forces, Translation No. F-TS-981-RE*, February, 1947. 28 pp., figs. 7 references.

The drag on the wing was determined by means of impulse surveys for various air quantities and temperatures. The exhaust slots, of variable width, extended over the whole span at 15, 30, and 60 per cent chord from the leading edge of the wing.

Wind-Tunnel Measurements of a Jet-Propulsion Model with Cold Jet and a Wing as a Boundary. II. W. Lehmann. (*Arado-Flugzeugwerke, Deutsche Luftfahrtforschung Forschungsbericht Nr. 1902/2*, November 4, 1943.) *U.S., David Taylor Model Basin, Translation No. 218*, January, 1947. 19 pp., figs.

Three-component measurements were made in a wind tunnel for clarification of the forces and moments acting on a gas-turbine power plant, and for the determination of the combined forces. Two jet-propulsion models of different lengths, with a cold jet, were used, as well as a power-plant model with a wing as a boundary. Referring to the power plant alone, an increase of lift occurs for a nacelle with a jet, and the lift-curve slope thereby also increases with increasing jet velocity. The thrust based on the jet area is the same for the two nacelles at equal jet velocities. Measurements of the longer power plant with a wing as a boundary showed an increase in the side forces acting on the power plant, compared with the measurements of the nacelle alone, which might be caused by the end-plate effect of the wing.

Wind-Tunnel Investigation of an NACA 23012 Airfoil with a 0.30-Airfoil-Chord Double Slotted Flap. Paul E. Purser, Jack Fischel, and John M. Riebe. *U.S., N.A.C.A., Advance Restricted Report No. 3L10* (*Wartime Report No. L-469*), December, 1943. 49 pp., figs. 6 references.

Notes on the Effects of Trailing-Edge Shapes of Low-Drag Airfoils on Profile Drag and the Trim and Balance of Control Surfaces. W. J. Underwood. *U.S., N.A.C.A., Confidential Bulletin* (*Wartime Report No. L-450*), March, 1942. 4 pp., figs.

Conference Report on Problems of Aerodynamic Stress. Braun. (*Germany, Oberkommando der Luftwaffe, ZWB/OKL/-577/44*, September, 1944.) *U.S., Army Air Forces, Translation No. F-TS-905-RE*, February, 1947. 5 pp.

Wind-tunnel measurements on various N.A.C.A. profiles, ailerons of Me 109, lift distribution measurements on Me 262, and various aerodynamic data on He 219 were included in the discussion.

Force and Pressure-Distribution Measurements on a Rectangular Wing with Double-Hinged Nose. H. A. Lemme. (*Göttingen, ZWB/FB/1676/3*, June 2, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1117*, March, 1947. 9 pp., figs. 3 references.

Attempts were made to reduce the low-pressure peaks at the bend of the hinged nose which favor flow separation, by reducing the camber of the forward profile and thereby insure a longer adherence of the flow and a maximum lift increase. The measurements disclosed that the highest lift attained with a single-hinged nose cannot be increased by a double-hinged nose. The sum of the deflection angles of both hinged noses related to the maximum lift is about equal to the corresponding angle of the single-hinged nose (approximately 30° to 40°). Even the low-pressure peak is about the same in both cases.

Effect of Compressibility at High Subsonic Velocities on the Moment Acting on an Elliptic Cylinder. Carl Kaplan. *U.S., N.A.C.A., Technical Note No. 1218*, March, 1947. 44 pp., figs. 2 references.

An extended form of the Ackeret iteration process is utilized. The angle of attack with respect to the direction of the undisturbed stream is assumed small and the circulation is fixed by the condition that the trailing end of the major axis be a stagnation point. The expression for the moment acting on the elliptic cylinder is derived and shows a first-step improvement of the Prandtl-Glauert approximation. A second-step improvement is obtained in the Prandtl-Glauert approximation for the lifting force acting on the elliptic cylinder. By means of these two results it is possible to calculate the effect of compressibility on the position of the center of pressure as a function of the thickness coefficient and of the stream Mach Number.

Effect of Finite Span on the Airload Distributions for Oscillating Wings. I—Aerodynamic Theory of Oscillating Wings of Finite Span. Eric Reissner. *U.S., N.A.C.A., Technical Note No. 1194*, March, 1947. 39 pp., tables. 10 references.

A formula is derived for the pressure distribution on an oscillating lifting surface of finite span under the assumption of a ratio of span to average chord (aspect ratio) that is not too small. The range of validity of this formula, so far as aspect-ratio limitations are concerned, is not less than the range of validity of lifting-line theory for the nonoscillating wing. It is found that the effect of three-dimensionality of the flow may be incorporated in the results of the two-dimensional theory by adding a correction factor to the basic function of the two-dimensional theory. The correction term is a function that depends on wing plan form, wing deflection function, and reduced frequency. Its determination requires the solution of an integral equation that is similar to the integral equation of lifting-line theory.

Adiabatic Flow in Pipes. I. J. Lukasiewicz. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 55–59, figs. 31 references.

The graphical methods of one-dimensional gas dynamics are reviewed and developed to obtain a complete representation of adiabatic flow of perfect gases in ducts of constant cross section. Dimensionless charts, from which the variation of the state of the gas along the duct axis can be determined, are analyzed and the methods of their construction are given. The form of the charts depends only on the value of the ratio of specific heats. Exponential and linear approximate solutions for the flow in pipes are considered and it is shown that the linear is a better approximation. Sub- and supersonic flow in pipes and the formation of plane shock wave are discussed. The charts make it possible to specify the conditions in which choking will take place or shock will be formed, and to determine the theoretic shock-wave position. The published information on the magnitude of the friction coefficient in compressible sub- and supersonic flow in pipes is reviewed and the main experimental results are given.

Aerodynamic Tests of an M-31 Bomb in the 8-Foot High-Speed Tunnel. Donald D. Baals and Norman F. Smith. *U.S., N.A.C.A., Memorandum Report* (*Wartime Report No. L-132*), August, 1942. 17 pp., illus.

Drag Measurements of a Protruding .50-Caliber Machine Gun with Barrel Jacket Removed. Arvo A. Luoma. *U.S., N.A.C.A., Memorandum Report* (*Wartime Report No. L-581*), January, 1943. 11 pp., figs. 2 references.

Model Aircraft Illustrating Sign Convention Used in Applied Aerodynamics. F. W. Free. *The Royal Aeronautical Society, Journal*, Vol. 51, No. 434, February, 1947, pp. 197, 198, figs.

The tunnel model is painted so that one color represents all positive movements and directions when that color leads the direction of movement, and a second color represents all negative movements and directions. This simplifies visualization of the standard sign convention for controls, movements along and moments about the x, y, and z axes, particularly when the model is inverted.

Air Laws and Regulations

Red Tape in International Air Travel. William A. M. Burden. *Air Transport*, Vol. 5, No. 3, March, 1947, pp. 41–44, illus.

Air Transport—General

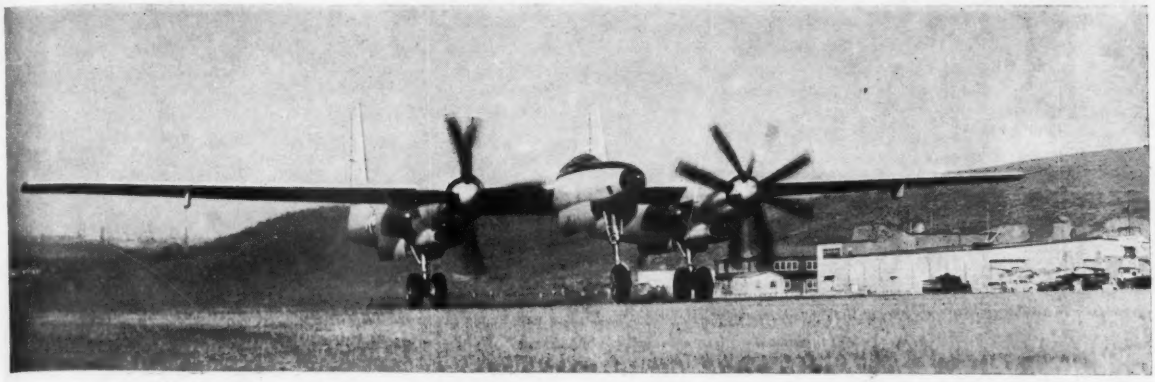
Review of Air Transport Developments for the Year 1946. O. E. Kirchner. *Preprint, S.A.E. Annual Meeting*, Detroit, January 6–10, 1947. 61 pp., figs. A review of engineering developments.

Pertinent Economic Factors in Air Transportation—1947. Hal E. Nourse. *Preprint, S.A.E. Annual Meeting*, Detroit, January 6–10, 1947. 3 pp. A forecast.

Lessons from the R.A.F. Transport Command. I. Sir Ralph Cochrane. *The Aeroplane*, Vol. 72, No. 1864, February 14, 1947, pp. 187–189, illus. (Extended abstract of a paper: Air Transport During the War.)

Air Transport, Cargo

Let's Take the Glamour Out of Airfreight. I—Airfreight Sales. Robert F. Odell. *Distribution Age*, Vol. 46, No. 3, March,



The XF-11 reconnaissance airplane, built and recently test-flown by Howard Hughes, is powered by two 3,000-hp. radial engines with eight-bladed counterrotating propellers.

1947, pp. 39, 42, illus. Problems connected with selling of air-freight service, and their solutions, are discussed.

What Air Freight Carriers Can Expect from New York's Glamor Industry. III. L. H. Brittin, Bertram Ault, and Roger Mayhill. *Air Transportation*, Vol. 10, No. 2, February, 1947, pp. 33–36, 44, illus. (Cf. AER 4/47:38.)

Terminal Facilities for Air Freight. Sam Dunlap. *Southern Flight*, Vol. 27, No. 3, March, 1947, pp. 26, 27, 41, illus.

The Airfreight Issues. John H. Frederick. *Distribution Age*, Vol. 46, No. 3, March, 1947, pp. 36, 38, 44, 53, illus. A plea for the early certification of air-freight carriers by the Civil Aeronautics Board.

Air Transport, Scheduled

Foreign Airlines of the World (Including United States Territories). *Air Transportation*, Vol. 10, No. 2, February, 1947, pp. 24–26. A table giving the addresses, areas of operations, and airplanes in use by 165 air lines.

Air Services in Britain. I, II. *Modern Transport*, Vol. 56, Nos. 1455, 1457, February 1, 15, 1947; p. 7, illus.; p. 7, illus.

I. A review of the international air services operated by and for the four principal British railways, which have supported the plans for the expansion of air transport within the United Kingdom. Particulars are given about the activities of the Great Western Railway. II. The formation of Railway Air Services, Ltd., jointly owned by the four principal railroads and Imperial Airways, is reviewed.

Argentine Air Transport. *Modern Transport*, Vol. 56, No. 1457, February 15, 1947, p. 21.

Philippine Carriers Flourish with U.S. Surplus Equipment; Poor Surface Transportation Stimulates Air Travel Boom. Wayne W. Parrish. *American Aviation*, Vol. 10, No. 21, April 1, 1947, pp. 29, 30. Includes brief résumés of the financial structure, organization, equipment, and operations of eleven companies.

Ansett's Have Got There the Hard Way (Ansett Airways Pty. Ltd.). Stanley Brogden. *Aircraft* (Melbourne), Vol. 25, No. 5, February, 1947, pp. 15–22, 34, 36, 38, illus.

ANA—Australia's Aviation Giant (Australian National Airways). Stanley Brogden. *Aircraft* (Melbourne), Vol. 25, No. 4, January, 1947, pp. 17–28, 31–34, illus.

Civil Aviation in Sweden. J. G. Drummond. *Shell Aviation News* (London), No. 105, February, 1947, pp. 6–9, illus.

What's Right with the Airlines? II. Herb Powell. *Air Transport*, Vol. 5, No. 3, March, 1947, pp. 38–40, illus. (Cf. AER 4/47:38.) Replies by the air lines to *Fortune's* (August, 1946) criticism of the air transport industry concerning limousine service and baggage handling.

Airplane Descriptions

Aviation's 1947 Yearbook. *Aviation*, Vol. 46, No. 3, March, 1947, pp. 67–124, illus.

Descriptions, photographs, and three-view drawings of over 240 American and foreign civil and military airplanes, including helicopters. Specifications and performance characteristics, with additional data on engines, are given in a large 2-page supplementary table.

The "Bullet"—New Lightplane. *Aero Digest*, Vol. 54, No. 3, March, 1947, p. 46, fig. Particulars about a new all-metal, low-wing personal plane, designed by Johnson Aircraft Corporation and powered by a 125-hp. Continental engine.

Personal Planes for 1947. *Skyways*, Vol. 6, No. 4, April, 1947, pp. 40–56, illus. Brief descriptions and illustrations of 29 American light airplanes.

The Arsenal de l'Aéronautique VB-10 Cl. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 43–45, 47, illus.

Constructional features of a French twin-engined fighter now in production. Wing span is 51 ft.; length, 42.5 ft.; normal gross weight, 14,800 lbs.; rated power, 2,700 hp.; maximum speed at 23,000 ft., 435 m.p.h.; service ceiling, 36,000 ft.; and maximum range, 1,620 miles. The tandem engines drive two 3-bladed contrarotating propellers. The military load consists of four 20-mm. cannon and 600 rounds, six 12.7-mm. machine guns and 2,400 rounds, and two 1,000-lb. bombs or drop tanks.

The S.N.C.A. du Nord 1101 Noralpha. *The Aeroplane*, Vol. 72, No. 1863, February 7, 1947, p. 166, illus.

General specifications and performance characteristics of a French low-wing, four-place light aircraft, powered by a 220-hp. Renault 6-Q.10 six-cylinder, air-cooled engine. Cruising speed is 138 m.p.h. at 75 per cent power.

Percival Programme. *Flight*, Vol. 51, No. 1991–3, March 6, 1947, p. 200, diagr.

Preliminary specifications of the Percival P.50, an eight–ten passenger feeder-line or charter airplane, to be powered by two Alvis Leonides 505-hp. engines. Span will be 56 ft.; length, 39 ft. 7 in.; disposable load, 3,260 lbs.; cruising speed at 70 per cent power at 6,000 ft., 195 m.p.h.; service ceiling, 25,000 ft.; and duration at 6,000 ft., 4.8 hours.

Report on German Aircraft Me/110 G-4/R-3. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 1-12.* 12 pp., illus. British Information Services, New York. $0.35.

Explaining Russian Aeroplane and Aero-Motor Nomenclature. *The Aeroplane Spotter*, Vol. 8, No. 182, March 8, 1947, pp. 42, 43, illus.

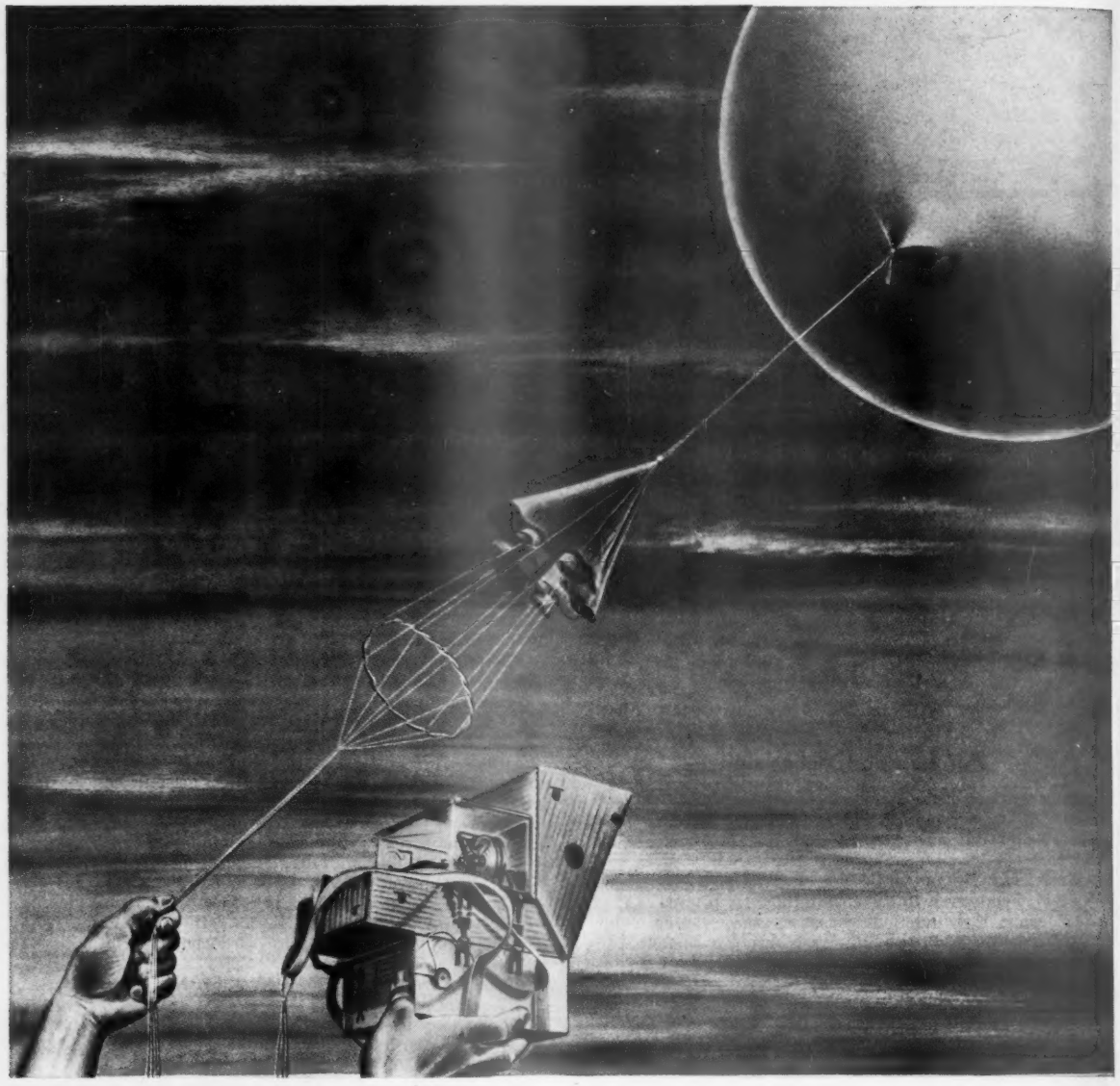
Airplane Design

Tailless Aircraft Design Problems. G. H. Lee. *The Royal Aeronautical Society, Journal*, Vol. 51, No. 434, February, 1947, pp. 109–129, Discussion, pp. 129–131, figs. 24 references. (Cf. AER 2/47:37.)

Swept-back wings, low-speed stalling and high-lift devices, compressibility effects, and aeroelastic problems are dealt with in detail. Fundamental redesign of airfoils is considered necessary to solve the tip-stall problem. Knowledge of the effect of sweepback in incompressible flow must be extended.

The Sweptback Wing. D. R. Newman and J. C. Wimpenny. *Shell Aviation News* (London), No. 102, October, 1946, pp. 14–17, illus.

The use of the sweepback improves performance at high Mach Numbers. The determining stability and control features of swept-back wings are the bad tip stall, necessitating the fitting of



Weather—with Laboratory Accuracy

The new Kollsman radiosonde modulating units, for sampling the temperature, humidity and pressure at varying altitudes, have made possible a considerable improvement in accuracy of readings, greatly facilitating all forms of weather reporting and forecasting. They represent only one of several fields to which Kollsman has contributed a new order of accuracy.

KOLLSMAN INSTRUMENT DIVISION

SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA

tip slats or some other cure, the poor increase of maximum lift due to flaps and slots, and the influence of flexural deflection upon control, longitudinal stability, and flutter. The ultimate logical development of the swept-back wing is the delta arrangement with a high degree of sweepback on the leading edge and an approximately straight trailing edge. This would appear to be suitable for extremely high speeds.

High Speed Integration. E. N. B. Bentley. *Aeronautics*, Vol. 16, No. 2, March, 1947, pp. 38–42, figs.

Compressibility effects are explained and information is given about the principles of the laminar-flow wing, sweepback, and tailless aircraft. Gas turbines and turbine-propeller combinations are discussed.

Supersonic and Transonic Aircraft Problems. Carl E. Reichert. *American Rocket Society, Journal*, No. 60, March, 1947, pp. 24–33, figs.

Engineering Problems of Future Aircraft: General Discussion. *The Royal Aeronautical Society, Journal*, Vol. 51, No. 434, February, 1947, pp. 173–196.

The Effect of Civil Air Regulation Performance Requirements on Airplane Design. John E. Steiner. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 13 pp., figs.

The method of analysis and the charts developed in this study are intended to indicate trends and relative performance of one design by comparison with another. The charts are based upon conventional airplanes having reciprocating engines and certain assumed external configurations, but reasonable adjustments for specific characteristics will make them applicable to other design specifications, including the use of turbine-propeller power plants.

Suggested Design and Operating Requirements for Cargo Transports. J. E. Winchester. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 12 pp., figs.

Two general types are visualized—a long-range airplane with four engines and pay-load capacity of 20,000 to 25,000 lbs., capable of coast-to-coast flight with not more than one stop for refueling; and a short-range twin-engined airplane of about 10,000 to 12,000 lbs. capacity for flights of 800 to 1,000 miles, designed for frequent stops and take-offs. Detailed suggestions are made for the design of the airplane and for economical maintenance and operating practice.

Development of Functional Cockpits for Naval Aircraft. Norval R. Richardson. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 10 pp.

Root Stalls and the Non-Spinnable Airplane. Richard G. Naugle. *Western Flying*, Vol. 27, No. 3, March, 1947, pp. 16, 17, 38, illus.

Wing Sections Without Layouts. C. F. Allen. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, p. 51, figs. An accurate method by which these sections can be obtained for a straight tapered wing shape is described.

Trends in Aircraft Structures. H. E. Hoben. *Preprint, S.A.E. Annual Meeting*, Detroit, January 6–10, 1947. 2 pp.

Some of the developments that will require changes in air-transport maintenance procedures include flush-riveted surfaces, 75S-T Alclad material, laminar-flow wings, higher cabin pressure, higher wing loading, and new types of landing gear.

The de Havilland Hornet Wing Spar. R. H. T. Harper. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 46, 47, illus.

Cargo Release Mechanisms. II. W. L. Spielman and A. D. Neal. *Aero Digest*, Vol. 54, No. 3, March, 1947, pp. 40, 41, 138, 140, figs. (Cf. AER 1/47:43.)

A description of tests to demonstrate the feasibility of using an explosive-type release mechanism; to determine the safety factor; to check operation at various temperatures; to investigate hazards to personnel; to establish the proper constructional materials; and to design electrical test equipment to check continuity of the release circuit.

Evolution and Design of the XFD-1 Phantom. III. Kendall Perkins. *McDonnell Airscoop*, Vol. 6, No. 20, March, 1947, p. 2, illus. (Cf. AER 3/47:51.)

Airports and Airfields

Road and Airfield Construction (in Germany). Dwight W. Winkelman. *U.S., Field Information Agency, Technical, Final Report No. 518*, November 20, 1945. 40 pp., illus. British Information Services, New York. $0.15.

The Reconstruction of Schiphol Airport (Amsterdam). I, II. *Modern Transport*, Vol. 56, Nos. 1456, 1458, February 8, March 8, 1947; pp. 3, 4; pp. 7, 8, 28; illus.

Planning Your Airport. III—Buildings and Service Facilities. Eugene V. Fryhoff. *Airports*, Vol. 11, No. 3, March, 1947, pp. 20, 21, illus.

Low Cost Traffic Control: How to Make Small Airport Wind and Landing Direction Indicators More Effective for Safer Traffic Control. II. Robert C. Blatt. *Aviation Maintenance & Operations*, Vol. 7, No. 4, March, 1947, pp. 30–32, 93–97, illus. (Cf. AER 4/47:42.)

Airways and Traffic Control

The Application of Microwaves to Instrument Landing of Airplanes. Joseph Lyman. *Aeronautical Engineering Review*, Vol. 6, No. 4, April, 1947, pp. 26, 27, 69, figs. (Extended abstract.)

General requirements for control of air traffic and landing under poor weather conditions call for an instrument system establishing three fixed axes with reference to the earth and some part of the airport; the system should function automatically and continuously, require minimum supervision, and be free from radio interference or transmission irregularities; and the glide path should be straight. The continuous-wave microwave equipment described meets those requirements, providing azimuth and glide-angle guidance and distance indication.

Landing Aircraft with Ground Radar. J. S. Engel. *Electrical Communication*, Vol. 24, No. 1, March, 1947, pp. 72–81, illus.

Particulars are given about the design and operation of a mobile ground radio set, AN/MPN-1C, for guiding aircraft in landing under conditions of poor visibility and without special airborne facilities. The equipment comprises a search radar, a precision radar, and standard two-way radiotelephone air-ground facilities, all installed in a single trailer.

NAVAR—Coordinated System of Aerial Navigation. Paul R. Adams. *Air-Sea Safety*, Vol. 2, No. 3, March, 1947, pp. 42–51, illus.

Check and Double Check. C. F. Baufe, Jr. *Air Transport*, Vol. 5, No. 3, March, 1947, pp. 34, 35, illus.

An air-line pilot who has used both Ground Control Approach and the Instrument Landing System discusses some of the advantages of each type. The combined use of the two systems is suggested.

CAA and Airlines Versus GCA. William Kroger. *Air Transport*, Vol. 5, No. 3, March, 1947, pp. 30–33, 77, 78, illus.

Atomic Energy

Atomic Energy. (War Department Lecture Series.) *U.S., Army Air Forces, Intelligence Review No. F-IR-135-RE*, February, 1947. 79 pp., figs.

The text of seven lectures on the following subjects: explanation of energy, molecules and atoms, and the reactions upon which the study of nuclear physics is based; laboratory experiments in radioactivity; the quantitative relationships among atoms; chemical reactions; nuclear reactions; plutonium, uranium, and the methods of producing atomic fission; applications and limitations of nuclear energy, including the making and use of the atomic bomb.

Business and Finance

The Future of the British Aircraft Industry. I, II. Eric Hardy. *The Aeroplane*, Vol. 72, Nos. 1864, 1865, February 14, March 7, 1947; pp. 191, 192, 195; pp. 220–222.

I. A discussion of the effects of competition with other large aircraft producers, such as the United States and Russia, and of the growth of air traffic as an indication of the future market. II. The probable expansion of Far Eastern air-transport routes will require greater production of aircraft. Consideration is given to the demand for aircraft by the fighting services and the air lines, and to government financing of production.

Control Systems

Flight Measurements of the Lateral Control Characteristics of Narrow-Chord Ailerons on the Trailing Edge of a Full-Span Slotted Flap. Richard H. Sawyer. *U.S., N.A.C.A., Technical Note No. 1188,* February, 1947. 18 pp., illus. 4 references.

The investigation included determination of the rolling and yawing characteristics of a modified Brewster F2A-2 airplane in abrupt aileron rolls with the slotted flap at various settings ranging from 0° to about 40°. Effectiveness of the ailerons was greatly reduced at flap deflections greater than about 20°. For flap deflections up to about 20°, the aileron effectiveness was about the same as with flaps retracted, but the adverse yawing velocity developed in the abrupt aileron rolls was somewhat increased.

Two-Dimensional Wind-Tunnel Investigation of Four Types of High-Lift Flap on an NACA 65-210 Airfoil Section. Jones F. Cahill. *U.S., N.A.C.A., Technical Note No. 1191,* Februfary, 1947. 47 pp., figs. 4 references.

Lift and pitching-moment data were obtained for the optimum configurations. Tests were made of three 25-per-cent-chord single-slotted flaps with the trailing edges of the slot lips located at 84, 90, and 97.5 per cent of the airfoil chord, and of a 31.2-per-cent-chord double-slotted flap. For the model with each of the flaps, the maximum lift was shown to become more sensitive to small movements of the flap as the flap deflection was increased. The maximum lift coefficient of the airfoil with each of the single-slotted flaps was shown to be about 2.47, and that with the double-slotted flap was 2.73 at a Reynolds Number of 6×10^6. The maximum lift coefficient increased as the Reynolds Number was increased in the range from 2 to 4 or 6×10^6, but in some cases it decreased at higher Reynolds Numbers. The decrement in maximum lift caused by standard roughness decreased as the flap deflection was increased and at the higher deflections was approximately the same as the decrement obtained with the plain airfoil.

Lift Tests of a 0.1536c Thick Douglas Airfoil Section of NACA 7-Series Type Equipped with a Lateral-Control Device for Use with a Full-Span Double-Slotted Flap on the C-74 Airplane. Robert J. Nuber and Fred J. Rice, Jr. *U.S., N.A.C.A., Memorandum Report No. L5C24a (Wartime Report No. L-841),* March, 1945. 34 pp., figs. 3 references.

A Longitudinal Control System for High Speed Aircraft. Harold O. Wendt. *Preprint, S.A.E. National Aeronautic Meeting (Spring),* New York, April 9–11, 1947. 13 pp., figs. 3 references.

A new system for obtaining the required control-force characteristics consists of two elevators on each side of the airplane. The large outer elevators are conventional spring-tab elevators, connected together and to the pilot's control column through a spring. Any deflection of the spring results in a relative motion between the elevator and the spring tab, in such a direction that the tab helps the pilot to move the elevator. The inner "feeler" elevators are directly connected to the control stick, and provide a control force in addition to that from the spring-tab elevators. This additional control force per g increases slightly with increasing air speed, tending to reduce the variation of stick force per g with air speed.

Lightplane Controls. *Aero Digest,* Vol. 54, No. 3, March, 1947, pp. 62–65, 140, 141, figs.

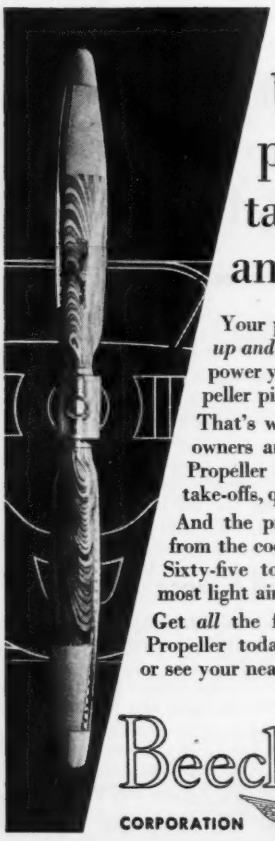
The principles of conventional three-control systems, two-control systems, and various arrangements to improve performance in flight and during landing and take-offs.

New Aileron Design Gives 2-0-2 Greater Flexibility, Easier Flying. *The Martin Star,* Vol. 6, No. 2, March, 1947, pp. 10, 11, illus.

The van Zelm aileron now used on Martin 2-0-2 and 3-0-3 air liners enables wing area to be reduced, makes possible a reduction in take-off distance and drag, and tends to prevent ice formation.

Aircraft Safety Locking System; New Handley Page Device. *Modern Transport,* Vol. 56, No. 1457, February 15, 1947, p. 10, diagr.

Failure to remove elevator, rudder, or aileron locks, secures the engine throttles in the "closed" position and prevents starting of the engines.



Use *all* the power for take-off, climb and cruise

Your plane's engine has plenty of *get-up and go.* But in order to use ALL the power you've got, you need positive propeller pitch control under all conditions. That's why more and more small plane owners are putting a Beech Controllable Propeller out in front. They get shorter take-offs, quicker climbs and faster cruising. And the propeller pitch is controlled right from the cockpit. Manual or electric control. Sixty-five to 250 horsepower models to fit most light aircraft.

Get *all* the facts on the Beech Controllable Propeller today. Write Beech Aircraft direct or see your nearest Beechcraft distributor.

Beech Aircraft

CORPORATION WICHITA, KANSAS, U. S. A.

Electrical Equipment

Control of D-C Aircraft Generators. A. T. McClinton. *Electrical Engineering,* Vol. 66, No. 4, April, 1947, pp. 362–364, figs. (Extended abstract of a paper.)

A proposed electric system provides for physical integration of all the control elements normally associated with a d.c. generator, through the use of a carbon-pile regulator as the basic element and additional elements necessary to produce a dependable system.

Engine Parts and Accessories

Aero-Engine Injection Carburettors. R. A. S. Reid. *Aircraft Engineering,* Vol. 19, No. 216, February, 1947, pp. 38–42, figs.

The working principles and the reasons for the use of so-called "injection" carburetor equipment are reviewed. The history of injection carburation is traced, and particulars are given about what is termed the "true injection carburetor" as developed in Great Britain.

Automatic Control Meters Fuel in Bendix Direct Injection. *Automotive and Aviation Industries,* Vol. 96, No. 4, February 15, 1947, pp. 40, 41, 94, diagr.

This unit meters fuel to the injection pump in amounts determined by automatic correction for altitude and temperature. Three principal elements are: an automatic mixture control; a regulator; and a metering-jet element. It is similar to the control unit of the Stromberg injection-type carburetor.

Characteristics of the BMW 801D2 Automatic Engine Control as Determined from Bench Tests. M. E. Scharer and A. N. Addie. *U.S., N.A.C.A., Memorandum Report No. E5D19 (Wartime Report No. E-192),* April, 1945. 56 pp., figs. 5 references.

Fuel Injectors for Daimler-Benz Aero Engines. (*Robert Bosch A.G., Stuttgart.*) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2581.* 26 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $1.30.

Robert Bosch Development of a Low Tension Spark Plug (System "Smits"); by Robert Bosch A.G., Stuttgart. Alfred J. Poole. *U.S., Field Information Agency, Technical, Final Report No. 624,* December 15, 1945. 6 pp., figs. B.I.S., N.Y. $0.35.

Report on the Robert Bosch (Stuttgart) Low Tension Ignition System. *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2578.* 5 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.25.

Low Tension Ignition (Junkers). J. R. Parry and C. A. Lindblom. *Combined Intelligence Objectives Sub-Committee, Item No. 19, File No. 29-53*, August 15, 1945. 6 pp., figs. British Information Services, New York. $0.20.

The Riedel Starter R.B.A./S10. (*Norbert Riedel KG, Bericht*, March 8, 1943.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2575.* 15 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.75.

Descriptions, specifications, and operating instructions are given for several types of aircraft engine starters. The R.B.A. S/10 consists of an air-cooled two-cylinder, two-stroke engine of about 10 hp., with suitable gearing, centrifugal coupling, starting clutch, and switches.

In-Line Aircraft-Engine Bearing Loads. III—Main-Bearing Loads. Milton C. Shaw and E. Fred Macks. *U. S., N.A.C.A., Technical Note No. 1206*, February, 1947. 53 pp., illus. 6 references.

The analysis applies to the computation of bearing loads in the V-type engine. Charts give the maximum and mean bearing loads for the center, intermediate, and end main bearings at all values of engine speed to 5,000 r.p.m. and at all values of indicated mean effective pressure to 500 lbs. per sq.in.

Latest Developments in Engine Bearings. I—Bearing Materials and Bearing Types. P. M. Heldt. *Automotive and Aviation Industries*, Vol. 96, No. 5, March 1, 1947, pp. 28–31, 58, 60, figs.

A discussion based in part on six papers presented at a meeting of the American Society for Metals. Available bearing metals are classified into two groups: those that are sufficiently soft to be used on the conventional crankshaft of heat-treated medium-carbon steel, without causing undue wear, and those that are harder and call for a special hardening treatment of the shaft bearing surfaces. Silver-lead bearings with a thin lead-indium overlay, aluminum bearings, copper-lead bearings, and mechanical approaches to increasing load-carrying capacity are considered.

Exhaust-Valve Temperatures in a Liquid-Cooled Aircraft-Engine Cylinder as Affected by Engine Operating Variables. Alois T. Sutor, Lester C. Corrington, and Carl Dudugjian. *U.S., N.A.C.A., Technical Note No. 1209*, February, 1947. 39 pp., figs. 6 references.

The operating temperatures of sodium-cooled exhaust valves were investigated for a large variety of engine conditions by means of a thermocouple embedded in the valve head. Measurements also were made of the exhaust-gas and the cylinder-head temperatures. The engine operating variables that affected the valve temperature most for a given percentage change in the operating variable were: (a) fuel-air ratio, (b) indicated mean effective pressure, (c) compression ratio, and (d) spark advance (for greatly advanced or retarded positions). The effects on valve temperature resulting from the injection of internal coolants are discussed.

An Investigation of Diffuser-Resistance Combinations in Duct Systems. Charles H. McLellan and Mark R. Nichols. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-329)*, February, 1942. 38 pp., figs. 4 references.

The Effect of Solidity, Blade Section, and Contravane Angle on the Characteristics of an Axial-Flow Fan. E. Barton Bell and Lucas J. DeKoster. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-304)*, December, 1942. 48 pp., figs. 3 references.

Generalized Selection Charts for Harrison and Tubular Intercoolers. George P. Wood and Arthur N. Tifford. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-287)*, December, 1942. 30 pp., figs. 10 references.

A Preliminary Investigation of the Characteristics of Air Scoops on a Fuselage. E. Barton Bell and Lucas J. DeKoster. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-275)*, December, 1942. 18 pp., figs. 3 references.

The Cooling Turbine (Steam Cooling of Aero-Engines Combined with Steam and Exhaust Driven Turbines). I. B. Klompus. (*Flugwehr und Technik*, Vol. 2, No. 9, September, 1940.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2580.* 10 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.50.

For the utilization of energy otherwise lost in the conventional aircraft engine, various devices have been developed, such as turbines driven by the exhaust gas or by steam generated in jackets around the main-engine cylinders and exhaust stacks. These devices serve to improve the useful power output and the cooling of the main engines, and to provide auxiliary power for cabin pressurization and other purposes. Descriptions and calculations are given for the design of the cooling turbine, the steam boiler on the cylinder head, the superheater and condenser, and other parts of the auxiliary power system. Figures and charts show the efficiencies and power savings obtained.

Operating Stresses in Aircraft-Engine Crankshafts and Connecting Rods. II—Instrumentation and Test Results. Francis J. Dutee, Franklyn W. Phillips, and Howard F. Calvert. *U.S., N.A.C.A., Memorandum Report No. E5H18 (Wartime Report No. E-191)*, August, 1945. 21 pp., illus. 2 references.

Investigation into the Design, Manufacture, and Inspection Technique of Aero Engine Gears (in Germany). P. A. Dyerson and W. John Davies. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 381, Item Nos. 18, 19, 26.* 155 pp., illus. 26 references. British Information Services, New York. $5.40.

Heat-Transfer Tests of a Steel Cylinder Barrel with Aluminum Fins with Improved Bonding Between Steel Barrel and Aluminum Base. Herman H. Ellerbrock, Jr. *U.S., N.A.C.A., Memorandum Report (Wartime Report No. E-196)*, July, 1940. 13 pp., illus. 8 references.

Silencers and Exhaust Pipes. (*Taschenbuch für den Autoingenieur.*) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2583.* 5 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.25.

Design requirements for automotive mufflers and exhaust pipes, with comparisons of five types: a reflection filter, a low pass filter, a reflection filter combined with absorption, a silencer with energy withdrawal through vorticity, and a simple filter working by absorption and subdivision of the exhaust gas stream.

Elastic Deformation of Piston Rings. H. W. Swift. *Engineering*, Vol. 163, No. 4232, March 7, 1947, pp. 161–165, figs.

A mathematical analysis of the relationship between ring form and wall pressures, using as examples an aircraft-engine piston ring and an automobile piston ring.

Possibilities of Reducing the Length of Axial Superchargers for Aircraft Motors. B. Eckert. (*ZWB/TB*, 1940.) *U.S., N.A.C.A., Technical Memorandum No. 1132*, January, 1947. 12 pp., figs. 3 references.

A comparison factor is developed to take account of the ratio of the overall axial extent of the rotor, the maximum outer diameter of the unit, and total-pressure factor. The comparison factor is applied to (1) a supercharger of normal construction; (2) a three-stage unit with bearings designed to reduce the length; (3) a four-stage axial supercharger with a reversing gear and two clockwise and two counterclockwise rotors; (4) a four-stage unit with two reversing gears whereby intermediate guide vanes are eliminated; (5) a five-stage unit using two reversing gears; and (6) a design in which two rotor stages are mounted on the shaft and three are fastened to a drum. The comparison factor is progressively reduced by each of these methods of construction, but limitations are imposed by the peripheral speeds of the drum in the sixth case, so that the highest total pressure head within the dimensional limits specified is obtained in the fifth case.

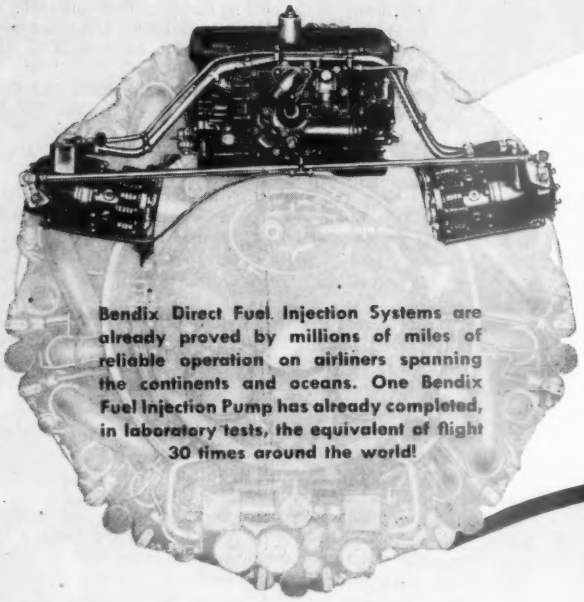
Experimental and Theoretical Studies of Surging in Continuous-Flow Compressors. Robert O. Bullock, Ward W. Wilcox, and Jason J. Moses. *U.S., N.A.C.A., Technical Note No. 1213*, March, 1947. 40 pp., figs. 8 references.

The investigations were made on three compressor units and the variation of static, total, or velocity pressure with time was recorded. In addition to the experimental studies, a simplified analysis was made to determine how instability of flow may occur in a compressor. An examination, based on this analysis, was made of several possible methods of inhibiting the occurrence of surging.

Performance of a Radial-Inlet Impeller Designed on the Basis of Two-Dimensional-Flow Theory for an Infinite Number of Blades. I. A. Johnsen, W. K. Ritter, and R. J. Anderson. *U.S., N.A.C.A., Technical Note No. 1214*, March, 1947. 33 pp., figs. 5 references.

The blade shape was determined by imposing a predetermined vortex distribution that was chosen to relieve the loading in the critical regions of the impeller passage. The performance of the

Bendix Direct Fuel Injection System



Bendix Direct Fuel Injection Systems are already proved by millions of miles of reliable operation on airliners spanning the continents and oceans. One Bendix Fuel Injection Pump has already completed, in laboratory tests, the equivalent of flight 30 times around the world!

. . . CAN ADD 900 LB. PAYLOAD

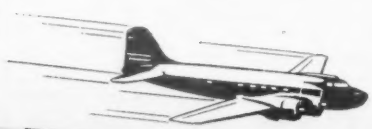
— — — — OR — — — —

INCREASE MILEAGE

— — — — — OR — — — — —

INCREASE SPEED

20 M.P.H.



No other mechanical advancement has added so greatly to large aircraft economy as has the Bendix* Direct Fuel Injection System. And these savings become doubly important in the light of the current emphasis most airlines are placing on lowered operating costs.

Actual airline reports show that this economy is achieved with greatly improved engine performance at high altitudes, more power, and better acceleration. Fuel distribution is precisely equalized between the cylinders, thus permitting the use of leaner mixtures. Engine stalls or faltering due to fuel feed failure are eliminated, as fuel feed is unaffected by the gravity or inertia effects of dives, banks or climbs.

Engines start more quickly, with less back-fires, and shorter warmups. Since intake passages carry only air, fire hazards are greatly reduced.

Fuel is vaporized within the cylinder, and there is no "refrigeration" of the intake manifold or carburetor and consequently no icing from fuel vaporization.

The Bendix Direct Fuel Injection System offers airlines the opportunity to add greatly to the comfort, safety and efficiency of their equipment, at the same time materially reducing operating expenses.

BENDIX PRODUCTS DIVISION of South Bend 20, Ind.

Bendix AVIATION CORPORATION

Bendix PRODUCTS DIVISION

*REG. U.S. PAT. OFF.

impeller was experimentally obtained in a variable-component test unit in conjunction with a vaneless diffuser of N.A.C.A. design. An analysis of flow characteristics in the compressor, using static-pressure experimental data, indicated that the peak impeller efficiency was high and that the low overall efficiency could be largely attributed to losses in the vaneless diffuser. The entrance loss, which became extremely large at high flow, was the principal factor determining the form of the compressor-performance curve.

Where Do We Stand on Under-Wing Fuel? H. O. Olson. *SAE Journal*, Vol. 55, No. 3, March, 1947, pp. 27–29. (Extended abstract of a paper: Under-Wing Fueling.) A review of recent developments. Emphasis is placed on safety devices to prevent overfilling.

Aero-Engine Oil System Design. S. K. Hambling. *Shell Aviation News* (London), No. 104, January, 1947, pp. 17–19, figs.

Aircraft-engine oil system shortcomings, made manifest by recent advances in operational altitude and the necessity for high rates of oil circulation to cope with increased severity of engine operating conditions, are classified as: loss of main oil pressure; failure of scavenge, with consequent transfer of oil from main tank to engine sump and subsequent pressure pump starvation; and excessive ejection of oil foam at the engine breathers. The causes of these failures are explained and remedies are suggested.

Engines—General

A Guide to Aircraft Power-Plant Selection. Arthur L. Lowell. *Aeronautical Engineering Review*, Vol. 6, No. 4, April, 1947, pp. 22–25, figs. (Extended abstract.)

A comparison of the relative performance of the rocket, the subsonic ram-jet, the turbojet, the turboprop, and the reciprocating engine, deriving charts of the comparative efficiencies for a wide selection of subsonic speeds and cruising ranges.

Approximate Graphical Determination of the Frequencies of Torsional and Flexural Vibrations. O. Föppl. (*Die Technik* (Berlin), Vol. 1, No. 7, January, 1947, pp. 329–332.) *The Engineers' Digest*, Vol. 4, No. 2, February, 1947, pp. 50–53, figs.

The conception of "vibration forces" is introduced, that is, of forces relating to the frequency $\omega = 1$. All other forces in the funicular polygon are considered to be "vibration forces" of identical dimension. With this conception, the frequencies of torsional vibrations can easily be calculated. By means of an assumed displacement curve, the frequency of flexural vibration of a shaft with overhanging end is determined, and, for this particular case also, the frequency of vibration of the second order is calculated.

Rotating Disks. A. H. Ehlinger. *Machine Design*, Vol. 19, No. 3, March, 1947, pp. 132–137, 186, figs.

The fundamental theory of stress analysis as applied to rotating discs is reviewed, and applied to disc problems, such as those connected with the design of gas turbines. Stress equations are developed for the thin ring and the constant-thickness disc, and are used as a basis for the sum and difference method and its application. Equations for the profiles of solid discs with external loading also are discussed.

Engines, Gas Turbine

Control of Aircraft Gas Turbines. M. A. Edwards and J. D. Thompson. *General Electric Co.* (For abstract see "I.A.S. Briefs" on page 27 of this issue, May, 1947.)

Design of Combustion Chambers for Gas Turbines. William R. Hawthorne. *Massachusetts Institute of Technology.* (For abstract see "I.A.S. Briefs" on page 27 of this issue, May, 1947.)

Aero-Thermodynamic Aspects of Aircraft Turbine Expansion Unit Design. Josh E. Talbert and J. C. Smith. *Wright Aeronautical Corp.* (For abstract see "I.A.S. Briefs" on page 26 of this issue, May, 1947.)

Determination of Turbo-Jet Engine Thrust from Tailpipe Measurements. Raymond W. Pyle. *Ryan Aeronautical Co.* (For abstract see "I.A.S. Briefs" on page 26 of this issue, May, 1947.)

Systematic Analysis of Thermal Turbojet Propulsion. Hans Reissner. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 197–210, fig. 15 references.

The propulsion unit consisting of six sections—free inflow, intake, compressor, heat chamber, turbine, and exit nozzle, is treated uniformly by the quintuple system of dynamic and thermodynamic flow equations with their power or heat inputs, the conditions of change of state (cycle), the continuity equations, and the thrust equation. These equations also comprise in each section the retarding forces and the heat creation of turbulent flow and the loss of mechanical power and of heat leakage. They form successive sets of equations, and their solution is derived in terms of the required data of altitude, flying speed, thrust, pressures in front and at the exit of the compressor, permissible entrance temperature at the turbine, and permissible ratio of power of compressor and turbine to heat input. The procedure is worked out for a perfect unit (that is, without losses) and is afterward completed for the percentage losses of heat and work in each section. The necessary heat input, propulsion effectiveness, distribution of temperatures, pressures, velocities and cross sections, the best cycle conditions, and the most efficient pressure-velocity relations at the exit are then determined by those data.

Analysis of Jet-Propulsion Engine Combustion-Chamber Pressure Losses. I. Irving Pinkel and Harold Shames. *U.S., N.A.C.A., Technical Note No. 1180*, February, 1947. 30 pp., fig. 1 reference.

The pressure-loss chart presented is based on the assumption that the pressure losses in the actual combustion chamber can be matched by those of an equivalent combustion chamber of constant cross-sectional area. By means of the chart, the pressure losses of combustion chambers of various designs can be specified by two numbers, one related to the friction pressure-loss characteristics and the other to the momentum pressure-loss characteristics. The overall pressure losses computed from the chart are within 7 per cent of the experimental values for the three types of combustion chamber studied.

Pressure-Distribution Measurements on the Rotating Blades of a Single-Stage Axial-Flow Compressor. Jack F. Runckel and Richard S. Davey. *U.S., N.A.C.A., Technical Note No. 1189*, February, 1947. 34 pp., illus. 6 references.

A preliminary investigation was made of the pressure distribution about the mean-radius section of the rotating blades at a blade Mach Number of 0.35. The results indicated that the maximum suction pressure for the thin, low-camber rotor blades tested (stagger, 70°, and solidity, 0.86, at mean-radius section) was only slightly greater than for the isolated airfoil of the same section. The lift-curve slope for the rotor blades was much lower than that estimated from theoretic calculations for a comparable two-dimensional cascade, indicating the necessity for using cascade test data to determine the blade-angle settings. Stalling of the flow in the compressor was found to originate at the root and tip sections of the blade as a result of the effects of casing boundary layers, improper blade twist, and large clearances.

Performance of Axial-Flow Fan and Compressor Blades Designed for High Loadings. Seymour M. Bogdonoff and L. Joseph Herrig. *U.S., N.A.C.A., Technical Note No. 1201*, February, 1947. 31 pp., illus. 4 references.

The performance of four sets of rotor blades, designed to set up free vortex flow and operating with design pitch-section lift coefficients from 0.31 to 0.99, was studied in a test blower by making surveys of yaw angles and pressures. Blades designed for loadings higher than those now in use gave peak efficiencies of approximately 96 per cent; a decided decrease in peak efficiency occurred for extremely low loading. For blades with a solidity of 1.0, design lift coefficients approaching 1.0 can be used with high efficiencies and a maximum lift coefficient of at least 1.4 can be obtained. The measured performance was close to that predicted from studies of stationary two-dimensional cascades in N.A.C.A. ACR No. L5F07a; the blade peak efficiency was close to the design point for high loadings; turning angles were within 1° of predicted angles; and at design conditions, 92 to 95 per cent of the ideal pressure rise was obtained. Extreme leading-edge roughness caused a 2.5–3 per cent decrease in efficiency and an 11–15 per cent drop in pressure rise at the design conditions.

Static-Load Tests on an Aircraft Gas Turbine to Simulate Loads Produced by Rapid Plane Maneuvers. A. W. Brunot and W. B. Goddard. *Journal of Applied Mechanics*, Vol. 14, No. 1, March, 1947, pp. A-15–A-20, illus. 2 references.

The method consists of applying a finite number of loads to the whole power-plant structure simultaneously in such a manner that these loads produce the same bending and shear, and restraints in the structural members, as would be encountered in actual flight. Stresses and deflections can be measured directly on the unit, and these load stresses can be combined with thermal and internal load stresses to establish margins of safety. Static-

CONFIDENCE... how much is it worth

IN 1841, two years before the first telegraph line was installed in this country, and when there were but 27 states in the Union, John August Roebling was inspired with the idea of making a new kind of rope of unheard of strength and flexibility. His confidence in his idea caused him to risk everything he had on the development of his new rope.

How much is his confidence worth to Industry today, which couldn't turn a wheel without the modern wire rope?

Today, the John A. Roebling's Sons Company invests much time, effort and money in the development of improved products to keep alive the confidence of its many customers.

Roebling values this confidence as its greatest asset. That's why it offers you the greatest value for every dollar you invest . . . in *any* Roebling product.

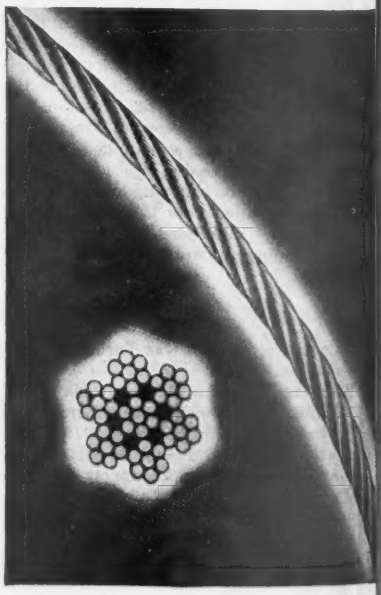
NOW... STRATOCORD FOR ACCURATE HIGH-ALTITUDE CONTROL

YOU expect certain "musts" in a control cord —strength, small diameter, flexibility, absence of constructional stretch, fatigue resistance. But today's new altitudes have created still another... high co-efficient of expansion. The answer...the control cord with *all* the "musts" is Roebling's new "Stratocord."

At high levels where low temperatures prevail, the duralumin airframe contracts more than ordinary steel control cord. The result has alway been sagging cords, sloppy controls. The solution was a special steel alloy.

Test after test was made. Now, the contraction and expansion of airframe are practically synchronized, flight controls remain taut, sensitive, instantly responsive.

Write today for full information on Roebling's new, improved control cord..."Stratocord."



Aircord Division

JOHN A. ROEBLING'S SONS COMPANY

TRENTON 2, NEW JERSEY

Branches and Warehouses in Principal Cities

Manufacturers of Wire Rope and Strand • Fittings • Slings • Screen, Hardware and Industrial Wire Cloth • Aerial Wire Rope Systems • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Ski Lifts • Electrical Wire and Cable • Suspension Bridges and Cables • Aircord, Aircord Terminals and Air Controls • Lawn Mowers

ROEBLING

A CENTURY OF CONFIDENCE

load tests on a specific gas turbine are described in detail, with results to illustrate the method.

An Investigation of the Aerodynamic Characteristics of a Rotating Axial-Flow Blade Grid. John R. Weske. *U.S., N.A.C.A., Technical Note No. 1128*, February, 1947. 43 pp., illus. 5 references.

The results of pressure-distribution, pitot tube, and hot-wire wake survey measurements were used as the basis of an analysis of the flow through the rotating grid, particularly of those effects not present in a fixed grid and of the factors not accounted for in the two-dimensional theory of axial-flow blade grids. Radial displacement of the boundary layer delays the stall of the root section and induces early stall of the tip section, which may become critical for the pumping limit of the blade row. Interaction of boundary layers along the casing and the hub and along the blade surfaces through radial flow represents a major factor not accounted for in the two-dimensional theory of blade grids. Radial displacement of the wakes is of similar importance.

New Temperature Total Heat-Entropy Chart for Gases with Variable Specific Heats. J. R. Finniecome. (*Institution of Mechanical Engineers, Advance Paper*, 1946.) *The Engineers' Digest*, Vol. 4, No. 2, February, 1947, pp. 73–76, figs. 8 references. (Extended abstract.)

A large-scale chart was prepared for the purpose of exploring the performance of gas-turbine plants of the constant-pressure cycle. It presents the thermodynamic values in ft.lb.-Fahrenheit units, rather than in lb.-molecule units.

Review of an Investigation of Ceramic Coatings for Metallic Turbine Parts and Other High-Temperature Applications. W. N. Harrison, D. G. Moore, and J. C. Richmond. *U.S., N.A.C.A., Technical Note No. 1186*, March, 1947. 28 pp., illus. 2 references.

Various refractory admixtures were incorporated in varying amounts and the coatings were applied and fired at different temperatures on several alloys. Some of the coatings will withstand 500 hours in air at 1,500 °F. with little visible change, while serving to eliminate or greatly reduce the oxidation that occurred on uncoated alloys which received the same treatment. The high-temperature load tests indicated that, at loads sufficiently low to permit a life of the alloy beyond 600 hours, some of the coatings had a significantly beneficial effect. It was also found that some of the coatings permitted alloys S-816 and S-590 to retain approximately their initial 0.2 per cent offset yield value under conditions that almost completely corroded the uncoated alloys, namely, heating in an H_2S atmosphere at 1,350°F. for prolonged periods.

Report on the Tests of the Escher Wyss AK Aerodynamic Turbine. H. Quiby. (*Schweizerische Bauzeitung*, Vol. 125, Nos. 23, 24, June 9, 16, 1945; pp. 269–273; 278–284.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2587.* 18 pp., illus. 5 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.90.

The rated power output is 2,000 kw. The turbines are designed for a normal expansion of about 4 to 1 between the successive stage pressures. Expansion without intermediate reheating takes place between two turbines in series. The high-pressure turbine running normally at 8,000 r.p.m. drives the axial compressor directly; the low-pressure stage is coupled to the generator and runs at 3,000 r.p.m.

Gas Turbine Fuel System Components. C. W. Rossiter-Smith. *Shell Aviation News* (London), No. 105, February, 1947, pp. 18–20, figs.

The construction and function of low-pressure fuel pumps, cocks, and filters; high-pressure fuel pumps and filters; barostats; throttle valves; overspeed governors; high-pressure cocks; dump valves; accumulators; burners; and flame igniters.

Aircraft Turbo-Jet and Prop-Jet Starter Systems. A. G. Bardwell, Jr. *American Rocket Society, Journal*, No. 60, March, 1947, pp. 16–23, figs.

Particulars are given about the requirements for existing starter systems and future systems of the self-contained and ground-powered types. A weight-power comparison of several systems under development is presented.

Description of Junkers .004 (203) Jet Propulsion Engines. J. P. Den Hartog, W. P. Roop, and others. *Combined Intelligence Objectives Sub-Committee, Item No. 5, 26, File No. 11-8, 12-9, 14-4.* 33 pp., illus. British Information Services, New York. $1.00.

Notes on Aircraft Gas Turbine Engine Developments at Junkers, Dessau and Associated Factories. D. N. Walker and F. E. Pickles. *Combined Intelligence Objectives Sub-Committee, Item No. 5, File No. 31-66.* 10 pp., fig. British Information Services, New York. $0.35.

Nene Installation: Details of Rolls-Royce Gas Turbine Power Units in a Lancastrian. *Flight*, Vol. 51, No. 1994, March 13, 1947, pp. 216a–216d, 217, illus.

Installation Engineering of Aircraft Turbo-Jet Engines. R. E. Small. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 6 pp., figs.

Engines, Ram-Jet

Gas-Dynamic Investigations of the Pulse-Jet Tube. I, II. F. Schultz-Grunow. (*Aachen, Technische Hochschule, Institut für Mechanik, (ZWB) Forschungsbericht Nr. 2015/1-2.*) *U.S., N.A.C.A., Technical Memorandum No. 1131*, February, 1947. 87 pp., figs., charts. 5 references.

Based on a simplified representation of the mode of operation of the pulse-jet tube, an investigation was made of the influence of the form of the jet tube, of the effective cross-sectional area of the valves, of leakiness in the valves, and of the speed of flight on the mode of operation of the pulse-jet tube and on the ratio of the amount of charge induced for the second cycle to the standard charge postulated for the first cycle. Consideration is given to the sequence of pressure changes during combustion. It is shown that for a jet tube with a form designed to be aerodynamically favorable, the ability to operate is at least questionable.

Engines, Reciprocating

Effect of Exhaust Pressure on the Performance of an 18-Cylinder Air-Cooled Radial Engine with a Valve Overlap of 40°. David S. Boman, Tibor F. Nagey, and Ronald B. Doyle. *U.S., N.A.C.A., Technical Note No. 1220*, March, 1947. 54 pp., illus. 4 references.

For any given engine speed and fuel-air ratio, good correlation of the power over the complete test range of inlet-manifold pressure and exhaust pressure was obtained by plotting the ratio of indicated mean effective pressure to inlet-manifold pressure against the ratio of exhaust pressure to inlet-manifold pressure. The average cylinder-head temperatures were found to increase as the exhaust pressure increased at constant conditions of fuel-air ratio, engine speed, inlet-manifold pressure, and cooling-air pressure drop. The effect became more marked as the fuel-air ratio decreased from 0.100 to 0.069.

Charts of Pressure Rise Obtainable with Airfoil-Type Axial-Flow Cooling Fans. A. Kahane. *U.S., N.A.C.A., Technical Note No. 1199*, March, 1947. 55 pp., figs. 5 references.

The charts cover fans of the stator-rotor, rotor-stator, and rotor alone configurations, with blades incorporating both the highly cambered 65-series blower-blade sections and the conventional low-cambered airfoil sections. The effects of operation of a geared fan with rotational speeds limited by compressibility considerations and the effects of initial rotational inflow are indicated.

Effect of Exhaust Pressure on the Cooling Characteristics of an Air-Cooled Engine. Michael F. Valerino, Samuel J. Kaufman, and Richard F. Hughes. *U.S., N.A.C.A., Technical Note No. 1221*, March, 1947. 38 pp., illus. 5 references.

An analysis of the results of an investigation conducted on an 18-cylinder, radial air-cooled engine installed on a dynamometer test stand. The tests covered a wide range of engine operating conditions including exhaust pressures from 7 to 65 in. of mercury absolute. The effect on average cylinder-head temperature can be predicted from the N.A.C.A. engine-cooling correlation within about 6 °F. for exhaust pressures ranging from approximately 10 to 50 in. of mercury absolute. The effect of exhaust pressure on engine cooling is greater at the lean than the rich mixtures.

Spark-Timing Control Based on Correlation of Maximum-Economy Spark Timing, Flame-Front Travel, and Cylinder Pressure Rise. Harvey A. Cook, Orville H. Heinicke, and William H. Haynie. *U.S., N.A.C.A., Technical Note No. 1217*, February, 1947. 15 pp., illus. 2 references.

An investigation was conducted on a full-scale air-cooled cylinder in order to establish an effective means of maintaining maximum-economy spark timing with varying engine operating conditions. Variable fuel-air ratio runs were conducted in which relations were determined between the spark timing and the basic factors in engine operation, flame-front travel, and cylinder-pressure rise. An instrument for controlling spark timing was de-

veloped which automatically maintained maximum-economy spark timing with varying engine operating conditions and indicated the occurrence of preignition.

Fuel Injection. M. O'Farrell. *Shell Aviation News* (London), No. 103, December, 1946, pp. 14–19, figs.

The characteristics and advantages of fuel injection are compared with carburetion. An analysis is made of the value of injection at high pressure directly into the cylinders, and injection at relatively low pressure into the individual intake pipes. Experiments with the latter type have not progressed far beyond single-cylinder testing but the advantages would appear to include ready adaptability to existing carburetor engines and light weight. Direct fuel injection gives greater power output than carburetion because of the greater internal cooling effect of the fuel spray, and also improved weak-mixture detonation performance. The advantages of fuel injection are counterbalanced to some extent by the cost and weight of available equipment.

Detonation and Internal Coolants. Edward F. Obert. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 14 pp., figs. 16 references.

Aspects of the combustion process are outlined and tests that indicate the effects of internal coolants (water or alcohol) on engine performance are described.

Aircraft Engines; Additional and Temporary Supercharge by the Use of Nitrous Oxide N_2O in the Air. R. J. Bender. *Combined Intelligence Objectives Sub-Committee, Item No. 26, File No. 32-44.* 17 pp., figs. British Information Services, New York. $0.55.

Three Times More Engine Power. Robert McLarren. *Automotive and Aviation Industries*, Vol. 96, No. 5, March 1, 1947, pp. 36–39, 62, 64, illus.

A review of developments in reciprocating engines produced by Allison, Chrysler, Continental, Lycoming, Menasco, Packard, Pratt & Whitney, and Wright.

Engines of the Société Mathis Aviation. *Shell Aviation News* (London), No. 105, February, 1947, p. 24. A table of the chief specifications and performances of eleven Series G engines, ranging from 40 to 500 hp.

German Diesel Engine Industry. L. P. Croset, V. H. F. Hopkins, and others. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 343, Item Nos. 18, 19, 26, 29, 31.* 309 pp., illus. British Information Services, New York. $7.00.

Disc Valve Engine Junkers Torpedo Engine, Model JUMO, KM 8. C. A. Lindblom and J. R. Parry. *Combined Intelligence Objectives Sub-Committee, Item Nos. 11, 19, File No. 31-61.* 50 pp., illus. British Information Services, New York. $2.20.

Engines, Rocket

Report on the Thermodynamic Calculation of the State of Combustion Gases. XXII—Methanol-Chlortrifluoride Reaction. Grete Ronge. (*Peenemünde, ZWB/PA/20/22*, October, 1943.) *U.S., Army Air Forces, Translation No. F-TS-1027-RE*, February, 1947. 6 pp., figs.

The reaction of methanol with chlortrifluoride resulting in hydrogen fluoride is highly exothermic. The calorific values of the reaction and the adiabatic pressure drop of the available combustion gases are tabulated. The purpose of the study was to find a suitable propellant for rockets and missiles. Methanol can be stored much more easily than ammonia and shows better combustion characteristics.

Report on the Thermodynamic Calculation of the State of Combustion Gases. VII—Ethyl Alcohol of Various Percentages of Water and Methyl Alcohol Plus Pure Oxygen. Grete Ronge. (*Peenemünde, Heeresversuchsstelle, ZWB/PA/20/7. U.S., Army Air Forces, Translation No. F-TS-1030-RE*, March, 1947. 14 pp., tables.

The report deals with the combustion of ethyl and methyl alcohol with different water content. At the combustion of an ethyl alcohol-oxygen mixture, with oxygen deficit corresponding to 0.6 g-atom oxygen to 1 g-atom carbon, maximum temperatures and exhaust velocities of the combustion gases were calculated, showing a pressure drop of 16 atm. to 1 atm. The exhaust velocity obtained with 100 per cent ethyl alcohol is 3.5 per cent higher than with 76 per cent ethyl alcohol.

Optol-Propellants. V—Ofan as Initiator. Roesler. (*I.G. Farben, ZWB/WVA/110/21*, April 4, 1944.) *U.S., Army Air Forces, Translation No. F-TS-908-RE*, February, 1947. 7 pp., tables.

In order to improve the ignition properties of optol which is an aniline, methyl alcohol, benzene and vinyl ether mixture, and furfural alcohol were added. Although the addition of furfural alcohol to optol caused no great advantage, furfural alcohol can easily be produced at lower cost and can act as substitute for other chemical compounds, which are part of optol, since it also accelerates ignition.

Rocket Powerplants for Aircraft. H. W. Burdett. *American Rocket Society, Journal*, No. 69, March, 1947, pp. 41–46.

Current applications of rocket power are reviewed and details are given about the Reaction Motors, Inc., Model 1500N4C power plant, its performance characteristics, and installation features. The practical application of the rocket engine to various types of aircraft in the near future is discussed.

Commercial Applications of Rocket Power. Dan A. Kimball. *American Rocket Society, Journal*, No. 69, March, 1947, pp. 34–36. Present and future applications of jet-assisted take-off and other uses for rocket power.

Rockets in the Desert; A Report on the Ordnance Firings at White Sands. Harvey Rivkins. *Army Ordnance*, Vol. 31, No. 161, March-April, 1947, pp. 425–431, illus.

Jet Propulsion; Rockets and Airstream Engines Will Power the Aircraft of the Future. Harold M. Shaw. *Army Ordnance*, Vol. 31, No. 161, March-April, 1947, pp. 434–437, illus.

Caves at Bas Mories, Near Vaas, Used for Storage of Peroxide by the Germans. W. H. Wheeler, R. Steele, and others. *Combined Intelligence Objectives Sub-Committee, Item No. 4, File No. 10-1.* 56 pp., illus. British Information Services, New York. $1.60.

Storage Tests with Ingolin Tanks. Wehage. (*H. Walter K.G., Kiel, WA/C8/Re/8*, April 7, 1942.) *U.S., Army Air Forces, Translation No. F-TS-1034-RE*, February, 1947. 5 pp., illus.

Forty Ingolin tanks of welded hydronalium 5 and stainless steel from the apparatus G7U were used in this experiment to determine durability under various temperatures and when surface-treated with various chemicals. The report gives the results of this 3-month test, stating which tanks stood up best under the testing conditions.

Underground German Liquid Oxygen Plant, Wittring. D. R. Dewey and G. M. Morrow. *Combined Intelligence Objectives Sub-Committee, Item No. 4, File No. 27-59.* 20 pp., illus. British Information Services, New York. $0.70.

Hydrogen Peroxide Works of Otto Schickert & Co., at Bad Lauterberg and Rhumspringe. A. Davidson, T. N. Blockley, and B. Vigers. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 294, Item No. 22.* 24 pp., illus. British Information Services, New York. $0.90.

Flight Technique

The History of Fuelling in Flight. *Aeronautics*, Vol. 16, No. 2, March, 1947, pp. 48–51, diagrs.

Flight Testing and Performance

A Method of Airplane Performance Calculation Applicable to Any Polar. R. E. Wendt. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 243–250, figs. 3 references.

By expressing mathematically the airplane polar about an axis of symmetry that coincides with the minimum drag coefficient obtained from wind-tunnel or flight data, airplane performance may be determined analytically with negligible error. The method provides a convenient means for determining rate of climb, level-flight speed, and time to climb. A chart permits the estimation of performance changes due to variations in weight and power. A basic performance parameter that is directly proportional to the propeller efficiency is given, which makes possible a qualitative comparison without a detailed analysis. A non-dimensional power-required curve is presented for graphical performance calculation without the labor of computing such curves for various weights and altitudes.

A Comparison of the Lateral Motion Calculated for Tailless and Conventional Airplanes. Charles W. Harper and Arthur L. Jones. *U.S., N.A.C.A., Technical Note No. 1154*, February, 1947. 48 pp., figs. 7 references.

In general, it can be expected that the mean value of the lateral displacements in disturbed motion will be of the same magnitude for a tailless and a conventional airplane, but the oscillatory

motion of the tailless airplane will be greater and considerably less damped. For a desired degree of maneuverability, the tailless airplane will require from one-half to one-third less directional control than the conventional airplane but will be much more significantly affected by small yawing moments such as would result from aileron yaw, asymmetry of power, and construction.

Wing Pressure-Distribution Measurements up to 0.866 Mach Number in Flight on a Jet-Propelled Airplane. Harvey H. Brown and Lawrence A. Clousing. *U.S., N.A.C.A., Technical Note No. 1181,* March, 1947. 58 pp., illus. 3 references.

Flight tests were conducted to determine scale and compressibility effects on the pressure distributions over a wing having an N.A.C.A. low-drag profile. For lift coefficients ranging from 0 to 0.60, no appreciable compressibility effects on spanwise wing loading were noted below 0.75 Mach Number. Above this Mach Number an inboard lateral shift of load occurred which is attributed principally to upfloating of the ailerons; extremely large aileron hinge moments were present, the result presumably of flow separation on the upper surface of the wing. The aileron flutter that occurred above 0.83 Mach Number was considered to be interrelated with the occurrence of these large hinge moments. The tests showed a more negative value of section pitching-moment coefficient as Mach Number increased up to about 0.78. From this peak negative value the pitching-moment coefficient rapidly shifted to much less negative values as the Mach Number was increased, especially for low lift coefficients. The variation of pitching-moment coefficient with lift coefficient became stabilized at Mach Numbers of 0.82 to 0.84.

Summary of Lateral-Control Research. Thomas A. Toll. *U.S., N.A.C.A., Technical Note No. 1245,* March, 1947. 193 pp., figs. 91 references.

A discussion is presented of the criteria used in lateral-control specifications, the factors involved in obtaining satisfactory lateral control, and the methods employed in making lateral-control investigations in flight and in wind tunnels. The available data on conventional flap-type ailerons having various types of aerodynamic balance are presented in a form convenient for use in design. The characteristics of spoiler devices and booster mechanisms are discussed. The effects of Mach Number, boundary layer, and distortion of the wing or of the lateral-control system are considered insofar as the available information permits. An example is included to illustrate the use of the design data. The limitations of the available information and some of the unsolved lateral-control problems are indicated.

Effect of Product of Inertia on Lateral Stability. Leonard Sternfield. *U.S., N.A.C.A., Technical Note No. 1193,* March, 1947. 17 pp., figs. 3 references.

The product of inertia results from the inclination of the principal longitudinal axis of the airplane to the flight path. The results of the calculations indicated that the product-of-inertia terms should be included in the lateral equations of motion to determine the lateral stability of an airplane. The value of the directional-stability derivative required for stability, as determined from the calculations which include the product of inertia, is considerably less than the value predicted by calculations neglecting the product-of-inertia terms.

Rolling Manoeuvring Loads of Aeroplanes. F. J. Plantema. *Netherlands, Nationaal Luchtvaartlaboratorium, Report No. S.318,* December 23, 1946. 18 pp., figs. 7 references. (In English.)

Calculations are presented to aid in establishing rational strength requirements for rolling conditions by determining an upper limit of the loads from the available strength of existing airplane types. The method of analysis and the results obtained with four airplanes (two fighters, one medium bomber, and one transport) are described. The strength calculations are carried out for the two limiting conditions, viz., the steady roll and the hypothetic accelerated roll with zero rolling velocity; the results are compared with the strength required by some existing strength specifications. It is essential to take good account of the influence of the wing twist under load, which may cause an extremely low aileron effectiveness at high speeds. The equations for the rolling motion due to sudden aileron deflections are solved under some simplifying assumptions. It is tentatively concluded that the accelerations actually occurring are so small that the strength requirements need only contain conditions of steady roll.

Frequency-Response Method for Determination of Dynamic Stability Characteristics of Airplanes with Automatic Controls. Harry Greenberg. *U.S., N.A.C.A., Technical Note No. 1229,* March, 1947. 28 pp., figs. 2 references.

The method is graphical and has several advantages over the standard numerical procedure based on Routh's discriminant. The chief advantage of the method is that direct use can be made of the measured response characteristics of the automatic pilot. This feature is especially useful in determining the existence, amplitude, and frequency of the hunting oscillations that may be present when the automatic pilot has nonlinear dynamic characteristics. Examples are worked out to illustrate the application of the frequency-response method in determining the effect of automatic-pilot lag or lead on critical control gearing and in determining the amplitude and frequency of hunting. The method may be applied to the case of a control geared to airplane motions about two axes.

Experimental Determination of the Yawing Moment due to Yawing Contributed by the Wing, Fuselage, and Vertical Tail of a Midwing Airplane Model. John P. Campbell and Ward O. Mathews. *U.S., N.A.C.A., Advance Restricted Report No. 3F28 (Wartime Report No. L-387),* June, 1943. 17 pp., illus. 5 references.

Wind-Tunnel Investigation of Effect of Yaw on Lateral-Stability Characteristics. V—Symmetrically Tapered Wing with a Circular Fuselage Having a Horizontal and a Vertical Tail. Arthur R. Wallace and Thomas R. Turner. *U.S., N.A.C.A., Advance Restricted Report No. 3F23 (Wartime Report No. L-459),* June, 1943. 28 pp., figs. 9 references.

Effect of Mach and Reynolds Numbers on the Maximum Lift Coefficient Obtainable in Gradual and Abrupt Stalls of a Pursuit Airplane Equipped with a Low-Drag Wing. John R. Spreiter, George M. Galster, and William K. Blair. *U.S., N.A.C.A., Memorandum Report No. A5G06 (Wartime Report No. A-5),* July, 1945. 26 pp., figs. 9 references.

A Flight Investigation to Increase the Safety of a Light Airplane. P. A. Hunter and J. R. Vensel. *U.S., N.A.C.A., Technical Note No. 1203,* March, 1947. 25 pp., illus. 1 reference.

Modifications of wing incidence, wing washout, elevators, tail, thrust axis, and rudder travel improved the stall, turn, and spin characteristics.

Fuels

Preboiling Evaporation Losses in Aircraft Fuel Tanks. L. M. Whitney, F. G. Bollo, and A. G. Cattaneo. *Shell Development Co.* (For abstract see "I.A.S. Briefs" on page 26 of this issue, May, 1947.)

The Mutual Adaptation of Aircraft Fuels and Aircraft Engines. S. D. Heron. (1946 Horning Memorial Lecture.) *Preprint, S.A.E. Annual Meeting,* Detroit, January 6–10, 1947. 17 pp. 9 references.

Progress in the development of aircraft fuels from World War I to the present is reviewed. Improved correlation of laboratory ratings and full-scale performance, preignition, fuel-air mixture distribution, stability in storage, and fuel combinations for turbines are discussed.

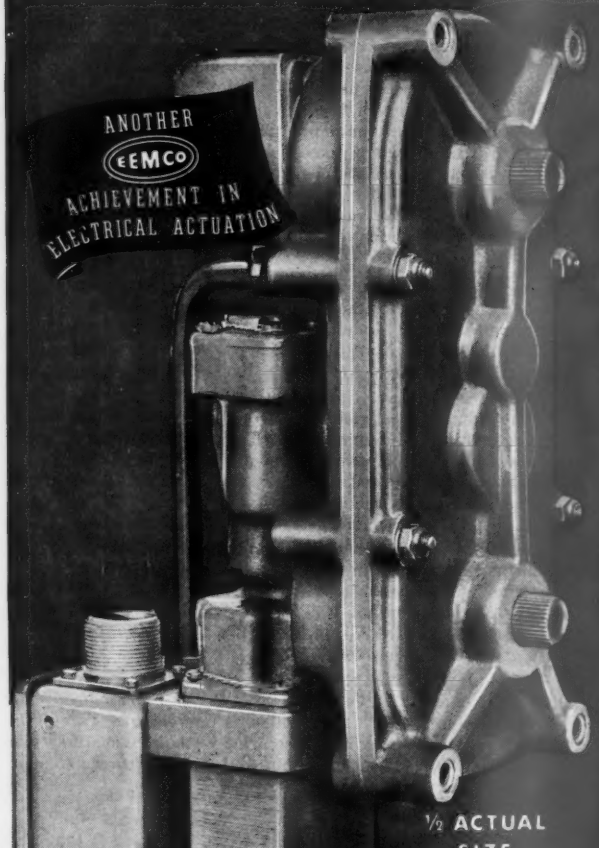
Smoking Characteristics of Various Fuels as Determined by Open-Cup and Laboratory-Burner Smoke Tests. Earl R. Ebersole and Henry C. Barnett. *U.S., N.A.C.A., Memorandum Reports Nos. E5F20, E5I12 (Wartime Report No. E-190),* June, September, 1945. 16 pp., figs. 1 reference.

Purification, Purity, and Freezing Points of 8 Nonanes, 11 Alkylcyclopentanes, 6 Alkylcyclohexanes, and 4 Butylbenzenes of the API-Standard and API-NBS Series. Anton J. Streiff, Evelyn T. Murphy, and others. *U.S., National Bureau of Standards, Journal of Research,* Vol. 38, No. 1, January, 1947, pp. 53–94, figs. 8 references. (Available also as *Research Paper No. 1760.* Govt. Printing Office, Washington, $0.20.)

Inflammability of Gasoline Vapor-Air Mixtures at Low Pressures (down to 30 mm. Hg). G. W. Jones and I. Spolan. *U.S., Bureau of Mines, Report of Investigations No. 3966,* October, 1946. 5 pp., figs.

Gliding and Soaring

Theoretical Analysis of the Lateral Stability of a Glider Towed by Twin Parallel Towlines. Marvin Pitkin and Marion O. McKinney, Jr. *U.S., N.A.C.A., Advance Restricted Report No. 3K17 (Wartime Report No. L-372),* November, 1943. 44 pp., figs. 2 references.



Torque • 275 in. lbs.
Time • 1 second
Power. ½ hp.

Here is the extraordinary performance of this

EEMCO ROTARY ACTUATOR

for opening camera hatch doors

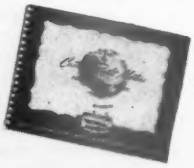
A leading aircraft builder put it up to EEMCO to achieve almost instantaneous opening of the camera hatch doors on an important new military plane. This electric-motor-operated Rotary Actuator was EEMCO's answer. With a peak load output of only .55 hp. it develops torque of 275 inch-pounds on each shaft in an operating cycle of only one second.

The engineer will recognize that achievement of such performance is a noteworthy feat of engineering. It was accomplished in the face of severe installation and operating requirements and weight limitation. Incorporation of a radio noise interference filter was a must. "No overtravel" was another must, therefore positive travel limit switches are included... also magnetic clutch and brake. Close integration of components and extreme compactness are self-evident in the photograph above.

Here is a typical example of the complete design, development, and production service EEMCO gives manufacturers.

TECHNICAL DATA Includes electric motor, magnetic clutch and brake, travel limit switches, and radio noise interference filter. Motor, 28 volt DC. Housings are magnesium castings. Weight, 7¾ lbs. Overall length, 13"; maximum height, 6-5/16".

NEW EDITION READY "Custom-Built Motors for a World of Needs" was prepared especially for design and project engineers, and all executives concerned with product design and engineering. Please send request on your company letterhead.



ELECTRICAL ENGINEERING and MFG. Corp. EEMCO

4606 West Jefferson Blvd., Los Angeles 16, California

Test-Flying the Eon Olympia. *The Aeroplane*, Vol. 72, No. 1864, February 14, 1947, p. 205, diagr.

Stall occurred at 30 m.p.h., and 33 m.p.h. was the minimum circling speed. The maximum permissible diving speed is 130 m.p.h., which can be limited by the use of dive brakes. Maximum towing speed is 70 m.p.h.

Guided Missiles

A Second Model Device for Oscillation-Stand Testing of the Effect of a Guide Beam During Combustion. Schubert. (*Peenemünde, Heeresversuchsstelle, ZWB/PA/86/48*, September, 1940.) *U.S., Army Air Forces, Translation No. F-TS-1053-RE*, February, 1947. 3 pp.

A model previously suggested did not provide for the increase of distance between missile and transmitter. For this reason, corrections are introduced in the equations of motion and are evaluated for three points of the trajectory.

Model for the Gyro-Pendulum Investigation in the Ignition Test and on the Oscillating Table. Eichler. (*Peenemünde, Heeresversuchsstelle, ZWB/PA/36/46*, September, 1940.) *U.S., Army Air Forces, Translation No. F-TS-1069-RE*, February, 1947. 5 pp., fig.

Analysis of the First Two American V-2 Flights. R. W. Porter. *American Rocket Society, Journal*, No. 69, March, 1947, pp. 37–41.

It is shown that the predicted performance closely approached the measured results of the tests with regard to trajectory, altitude, time of burning, weight, and c.g. of the missile.

Testing Naval Pilotless Aircraft. Grayson Merrill. *American Rocket Society, Journal*, No. 69, March, 1947, pp. 5–15, illus.

The nature of pilotless aircraft, existing and prepared flight-test ranges, preflight and flight testing, the facilities required for fight testing, and the evaluation of the missile as a military weapon.

Hydraulic Equipment

The Development of Ultra High-Pressure Hydraulic Systems. S. M. Parker. *The Engineer*, Vol. 183, No. 4753, February 14, 1947, pp. 167–170, figs.

Consideration is given to the temperature range required, power generation and regulation, and conversion to mechanical work. It is concluded that raising the pressure from 2,500 to 5,000 lbs. per sq.in. in light hydraulic systems would reduce the weight of aircraft equipment by about 10 per cent.

Design Features of the Martin 2-0-2 Hydraulic System. T. C. Hill and E. G. Riley. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 14 pp., figs.

Design requirements for the hydraulic system of a transport airplane, including satisfactory performance, reliability, economical maintenance, light weight, minimum fire and external-leakage hazards, and provision for emergency operation, were considered to be most suitably met by a combination of the 3,000 lbs. per sq.in. open-center system and the 1,500 lbs. per sq.in. closed-center system. Each component of the system is described in detail, as well as the tubing, connections, and other equipment.

Ice Prevention

Icing Report by the University of California, Fiscal Year 1946. *U.S., Army Air Forces, Technical Report No. 5529*, November 6, 1946. 133 pp., figs.

Contains eight reports by L. M. K. Boeler, H. A. Johnson, Myron Tribus, V. D. Sanders, M. W. Rubesin, George Young, and W. M. Robbins, Jr.: Summary of Engineering Services Rendered in Advance of Final Report; Experimental Determination of Heat Transfer and Pressure Drop Characteristics of Air Flowing in the Double Skin Passages of a Typical Leading Edge Thermal Anti-Icing System; Effect of Chordwise Conduction in the Skin of a Thermal Anti-Iced Airfoil; Aerodynamic Heating; The Limitation and Mathematical Basis for Predicting Aircraft Icing Characteristics from Scale Model Studies; An Analysis of the Heat Required to Maintain Dry or Slightly Ice Coated Surfaces on a Small Cylinder in Icing Conditions on Mt. Washington; Heat Transfer from Surfaces Subjected to Icing Conditions Atop Mt. Washington; Preliminary Tests of Use of a Double Pronged Probe in the Electrolytic Analogy Tanks. References are listed at the end of each report.

Testing of Production-Scale Anti-Icing System in the Me 210 Airplane. V. Bosch. (*Me/VB/Re/210-27 A-4Z*, November 22, 1943.) *U.S., Army Air Forces, Translation No. F-TS-910-RE*, February, 1947. 13 pp., illus.

The results of three flight tests showed that the electric thermal anti-icing system installed on the wings of the aircraft satisfactorily met all requirements in the icing zones flown.

Effects of a Simulated Ice Formation on the Aerodynamic Characteristics of an Airfoil. Beverly G. Gulick. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-292)*, May, 1938. 7 pp., illus. 1 reference.

Tests of a Thermal Ice-Prevention System for a Wing Leading-Edge Landing-Light Installation. Wesley H. Hillendahl. *U.S., N.A.C.A., Memorandum Report No. A4L11 (Wartime Report No. A-3)*, December, 1944. 13 pp., illus. 2 references.

Ice on the Viking. *Flight*, Vol. 51, No. 1994, March 13, 1947, pp. 218, 219, illus.

Information obtained from an extensive series of flying tests of the Vickers Viking under severe icing conditions and the measures taken to combat icing troubles.

TCA Finds Icing an All-Year Airline Operational Problem. Frank M. Holz. *American Aviation*, Vol. 10, No. 21, April 1, 1947, p. 39, illus.

A summary of icing conditions encountered, with a table of costs and weights of deicing equipment installed on the Lockheed Lodestar and the Douglas DC-3.

Instruments—General

The Balancing of Gyros. I—Observations on the Balancing of High-Speed Gyros with Some Customary Balancing Stands. K. Magnus. (*Göttingen, Universität*, January 28, 1940.) *U.S., Army Air Forces, Translation No. F-TS-902-RE*, March, 1947. 41 pp., figs.

Instruments, Engine

The NACA Mixture Analyzer and Its Application to Mixture-Distribution Measurement in Flight. Harold C. Gerrish, J. Lawrence Meem, Jr., Marvin D. Scadron, and Anthony Colnar. *U.S., N.A.C.A., Technical Note No. 1238*, March, 1947. 21 pp., illus. 5 references.

The mixture distribution among the nine cylinders of a radial engine in flight was obtained at normal operating conditions for the engine at an altitude of 5,000 ft. Some limited data were also obtained at an altitude of 20,000 ft. Results of these flight tests showed that the N.A.C.A. mixture analyzer is satisfactory for continuous indication of the mixture in flight at all engine conditions, regardless of altitude and temperature.

An Electrical Torque Meter Without Slip Rings for Measurements at Very High RPM's. W. Gohlke. (*Braunschweig, Luftfahrtforschungsanstalt Hermann Göring, Bericht.*) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2561.* 7 pp., diagrs. 3 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.35.

Temperature Indicator. F. Lichtenberger. (*Deutsche Versuchsanstalt für Luftfahrt, ZWB/FB/Re/470*, September 10, 1935.) *U.S., Army Air Forces, Translation No. F-TS-930-RE*, February, 1947. 10 pp., 13 references.

Two new systems for measuring gas temperatures taken off a running combustion engine are recommended; one utilizing a photocell for radiation measurements and the other a system for absolute gas temperature measurement.

Aircraft Detonation Indicators. J. S. Bogen and W. J. Faust. *Preprint, S.A.E. Annual Meeting*, Detroit, January 6–10, 1947. 32 pp., illus.

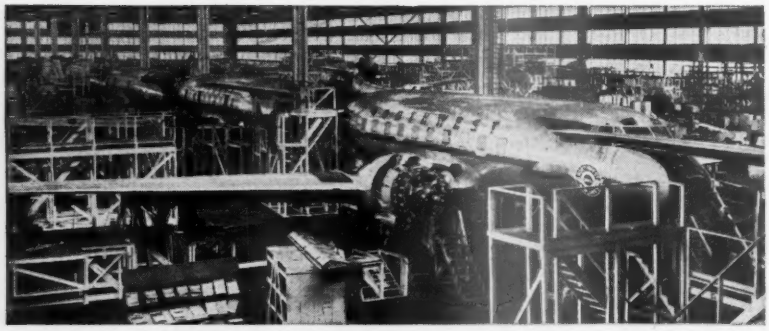
Detonation indicators for full-scale and laboratory aircraft-engine testing are described. All but one of the instruments respond to cylinder-head vibrations, that one being of the ionization gap type. Two of the pickups respond also to combustion-chamber pressure.

Instruments, Flight

Indicated, Calibrated, True, and Equivalent Airspeed. L. R. Lucassen. *Netherlands, Nationaal Luchtvaartlaboratorium, Re-*

Martin Memo

Published by The Glenn L. Martin Company
Baltimore 3, Maryland



On the Way . . . Here's the final assembly section of the Martin 2-0-2 production line. These 2-0-2's will soon go into operation for Northwest Airlines. Sixteen of the world's leading airlines have ordered Martin transports . . . with other sales as yet unannounced.

Now Flying . . . The Martin 2-0-2 luxury liner will soon set new standards in speed, comfort and dependability on these great airlines and cargo carriers: Capital (PCA) . . . Eastern . . . Chicago & Southern . . . Braniff International . . . United . . . Northwest . . . Delta . . . Panagra . . . Cruzeiro do Sul (Brazil) . . . Aeroposta (Argentina) . . . Nacional (Chile) . . . Mutual . . . Flying Tiger . . . Air Borne Cargo . . . U. S. . . . Willis.

Martin 2-0-2 Military . . . In military service, the twin-engine Martin 2-0-2 will provide the same efficiency and economy as the commercial model. Plans for the military version reveal that the 2-0-2 can carry 50 completely equipped soldiers or 15,000 pounds of cargo. Bulky cargo, engines and jeeps can be easily loaded through six by eight foot cargo doors.

Specialized Technical Training . . . in the operation, maintenance and repair of the Martin 2-0-2 has been made available by The Martin Company to the personnel of purchasing airlines. The objective of this program is to make the 2-0-2 more valuable to airline operators by enabling them to realize fully its operating and maintenance efficiency.

Lower First Cost . . . Martin's backlog, including orders for more transports than all competitors, spreads first production costs over a large number of planes. Martin quantity production gives purchasers these modern transports at a low cost.

Products of Experience . . . The Navy's new Martin Mauler—AM-1—is designed to operate from our largest carriers. It's the Navy's most powerful long-range, single seater, dive-torpedo bomber. Other aircraft being built by Martin for the Navy include the PBM-5 and PBM-5A Mariners, the JRM-2 Mars and the recently announced XP4M-1.

Operates for Less . . . Carrying 36 to 40 passengers (almost twice as many as prewar twin-engine transports) at a near 5-mile-per-minute clip, the Martin 2-0-2 cuts operating costs and turn-around time. This means more trips between inspections . . . greater profits for airlines.

A $195,000,000 Backlog . . . is going to make 1947 Martin's busiest peacetime year. Included are orders for postwar commercial airliners, cargo planes, advanced military aircraft and research in rocketry, pilotless aircraft and other scientific fields. This does not include orders for Marvinol . . . versatile plastic raw material.

15,000 Lbs. of Cargo . . . can be carried by the cargo version of the Martin 2-0-2. Special features include a large six by eight foot cargo door . . . a variety of specially designed bins, racks, shelves and refrigeration sections with ample nets and tie-downs for safe storage of cargo . . . a cargo compartment of 1,909 cubic feet. The Martin 2-0-2 cargo plane cruises a hundred miles an hour faster than prewar transports and can be operated for as little as 5½ cents per ton-mile.

Less Time at Airports . . . Fast underwing pressure fueling . . . reversible pitch propellers . . . optional built-in passenger ramps are a few of the features of the Martin 2-0-2 which cut ground-servicing and loading time.

Time-Saving Maintenance . . . Numerous doors and panels were designed in the Martin 2-0-2 to provide easy access to important maintenance locations. This facilitates routine inspections and major overhauls . . . expedites service. These built-in timesavers mean lower maintenance and servicing costs.

Martin
AIRCRAFT
Builders of Dependable Aircraft Since 1909

port No. V.1392, January 17, 1947. 11 pp., figs. 5 references. (In English.)

Explanations are given of the relationships between true air speed, indicated air speed, calculated air speed, and equivalent air speed. Equations are derived for calculating these values and the corrections to be made in converting from one value to another. The theory of the pitot-static tube is explained, as well as the allowances that must be made for instrument error, position error, pressure, density, and other factors.

Calibrations of Service Pitot Tubes in the Langley 24-Inch High-Speed Tunnel. W. F. Lindsey. *U.S., N.A.C.A., Memorandum Report No. L6A08 (Wartime Report No. L-580)*, February, 1946. 14 pp., illus. 3 references.

The Radio Altimeter and Flight Safety. W. H. Yates. *Air-Sea Safety*, Vol. 2, No. 3, March, 1947, pp. 19–23, illus. 1 reference.

The design, installation, and operation of the radio or radar altimeter, and suggestions for modifications of the antenna arrangement to provide greater efficiency.

Distant Reading Electrical Air Temperature Thermometer for Use on Aircraft. A. W. Brewer. *Journal of Scientific Instruments*, Vol. 24, No. 2, February, 1947, pp. 47–50, illus. 3 references.

The element resembles a Müller calorimetric resistance thermometer and is in the form of a flat plate with its edge directed into the airflow. The indicator is a Wheatstone bridge, balanced manually for each reading, the point of balance being indicated by a small two-pivot moving-coil galvanometer. The reading is accurate to $\pm^1/_2$°C.

Japanese Aircraft Instruments and Navigational Equipment. W. H. Schaller. *U.S., Army Air Forces, Intelligence Review No. F-IR-129-RE*, December, 1946. 34 pp., illus.

Includes detailed descriptions of three navigational computers, an astronavigation computer, a disc star finder, a star altitude chart, and an hour angle calculator. The characteristics of 21 other navigational instruments are tabulated. A report entitled "Dynamic Balancing of Gyroscopic Rotors," by Osamu Taniguchi, has been translated in full.

The Sperry Gyrosyn Compass. *Flight*, Vol. 51, No. 1994, March 13, 1947, pp. 207–209, illus.

Electron Gun Compass for Aircraft. H. Kliever and R. R. Syrdal. *Radio News*, Vol. 37, No. 4, April, 1947, Radio Electronic Engineering Dept., pp. 15, 30, 31, illus. (Cf. AER 3/47:67.)

The principles of the Cathotrol compass of Minneapolis-Honeywell Regulator Company, describing the characteristics of the cathode-ray tube design, the cathode-ray tube mounting, and the square potentiometer resolver; and outlining the advantages and other applications of the tube.

Instruments, Meteorological

An Improved Continuous-Indicating Dew-Point Meter. Frank A. Friswold, Ralph D. Lewis, and R. Clyde Wheeler, Jr. *U.S., N.A.C.A., Technical Note No. 1215*, February, 1947. 24 pp., illus. 6 references.

Remote Wind Reporting Equipment for Leased-Line Operation. Ronald L. Ives. *Journal of Aeronautical Meteorology*, Vol. 2, No. 4-5, July-October, 1946, pp. 128–141, figs. 15 references.

A description of equipment for continuous transmission of wind speed and direction data, obtained from any commercial contacting wind vane and anemometer, over a single pair of wires; and for converting the received signals into impulses suitable for operating indicating and recording devices. Pertinent constants are presented but detailed theory is omitted.

Insurance, Safety, and Rescue

What Causes Airline Accidents? John Stuart. *Air Transport*, Vol. 5, No. 3, March, 1947, pp. 21–26, illus., map.

A compilation of fatal accidents involving U. S. scheduled air lines which occurred from 1938 to 1946 is presented, and an analysis is made. In 59 per cent of the accidents, the pilot was at least partially responsible, and in these cases he was solely responsible in only 19 per cent. Weather, and weather with other factors, caused 49 per cent of the accidents, only 1 per cent being attributable to weather alone.

An Airline Pilot Looks at Air Safety. Jerry E. Wood. *Air-Sea Safety*, Vol. 2, No. 3, March, 1947, pp. 27–29, illus.

Accident Prevention. *Shell Aviation News* (London), No. 105, February, 1947, pp. 14–17, graphs.

Practical aspects of accident prevention and the safety problems confronting the aircraft operator are discussed, together with safety procedures followed in Great Britain.

Towards Air Safety. H. J. Saker. *Shell Aviation News* (London), No. 104, January, 1947, pp. 10, 11.

Spend Your Insurance Dollar Wisely. Gilbert C. Close. *Western Flying*, Vol. 27, No. 3, March, 1947, pp. 24, 26, 28, illus. Insurance policies for light airplanes and the importance of minor forms of insurance.

Landing Gear

Life of Tail-Wheel Tires, 350 × 135, at Various Landing Speeds. Schrode and Engert. (*Deutsche Versuchsanstalt für Luftfahrt, ZWB/UM/1381*, September 16, 1944.) *U.S., Army Air Forces, Translation No. F-TS-925-RE*, February, 1947. 6 pp., illus.

A number of endurance tests on balloon and nonskid (flat surface) tail-wheel tires of equal dimensions and equal inflation (approximately 70 lbs. per sq.in.) at landing speeds of 155, 195, and 220 km. per. hour. The device used in this test permitted only limited imitation of actual landing conditions. The failures encountered were mostly due to bursting or abrasion of the rubber surface, less frequently due to structural fatigue.

The Experimental Determination of Strains in Aircraft Landing Wheels and Brakes. Marvin H. Polzin. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 11 pp., figs.

Methods of taking strain measurements in static and in dynamic loading are described, with particular reference to the load-applying equipment, the technique of strain location and measurement during the various loadings, and the evaluation of loads, methods, and results. The dynamic method of testing is considered best for strain location and measurement, and static loading best for a complete picture of compression strains.

German Landing Gear Design, and Testing. P. H. Watson and S. A. Makovski. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 251, Item No. 25.* 20 pp., figs. British Information Services, New York. $0.70.

Landing Gear of Me 262 Airplane. J. M. Shoemaker. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 32-39*, August, 1945. 7 pp. British Information Services, New York. $0.35.

Lubrication and Lubricants

Foaming Volume and Foam Stability. Sydney Ross. *U.S., N.A.C.A., Technical Note No. 1153*, February, 1947. 15 pp., figs. 9 references. Data are given for a series of hydrocarbons and for a range of concentrations of aqueous ethylene-glycol solutions.

The Effect of Additives on the Coking Tendency of Lubricating Oils. O. Widmaier and L. Nenninger. (*Stuttgart, Technische Hochschule, ZWB/FB/1687*, November 4, 1942.) *U.S., Army Air Forces, Translation No. F-TS-953-RE*, March, 1947. 14 pp., figs. 52 references.

Rate Oil Performance in Flying Engines. J. T. Hendren. *SAE Journal*, Vol. 55, No. 3, March, 1947, pp. 38, 39, table. (Extended abstract of a paper: Flight Tests of Aviation Oils.)

Maintenance

How to Prepare a Maintenance Manual as Required by Part 42, CAR: A Practical Guide for Both Large and Small Operators as Recommended by the Non-Scheduled Aircraft Maintenance Division of CAA. *Aviation Maintenance & Operations*, Vol. 7, No. 4, March, 1947, pp. 21–25.

Flying Boat Repairs; An Account of Some Repairs to the Sunderland Flying Boat Carried Out by the Short Repair Organization. I. W. G. Reynolds. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 63–67, illus.

Rigging an Airplane. I—Introduction to Rigging. Harvey A. Senior. *Aviation Service Magazine*, March, 1947, pp. 16–21, figs.

Servicing the Miles Aerovan. I—The Aerovan from the Engineer's Viewpoint. S. Cooper. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 68–70, fig.

Materials—General

Non-Destructive Material Testing. E. Brandenberger. (*Schweizer Archiv*, Vol. 8, No. 4, May, 1942, pp. 157–165.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2559.* 10 pp., illus. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.50.

A comparison and evaluation of various methods and their applications: X-ray screening, fluoroscopy, and photography; gamma ray screening; magnetic powder process; magnetic induction process; the eddy current and other electrical methods; supersonic frequency testing; damping elasticity modulation (Ultraschall); interferometer method; and radiographic microstructure examination (reflex methods).

Non-Destructive Material Testing by Supersonic Methods. E. Czerlinsky. (*Jahrbuch der Deutschen Luftfahrtforschung*, 1942, pp. I723–I726.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2563.* 7 pp., illus. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.35.

By the acoustic image process the object is projected by means of sound rays and acoustic lenses onto a receiver which changes the acoustic image into an optically visible picture. If the test piece contains inhomogeneities that deflect the sound in transit, the corresponding points on the image will become visible as a result of their reduced reflecting power. The method is suitable for the testing of narrow cavities (shrinkage cracks in castings, doubling, adhesions) and Bakelite parts.

Material Testing by Supersonics. (*Der Ultraschall.* L. Bergmann. (Berlin, 1942.) Ann Arbor, Mich., Edwards Brothers, Inc., 1944, pp. 305–317.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2574.* 8 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.40.

The phenomenon of the approximately rectilinear propagation of supersonic waves, and the good diasonic properties of solid bodies, especially homogeneous metals, led to the application of supersonics to discover the presence of nonhomogeneities such as cavities, cracks, etc., when testing the material of large workpieces that could not be examined by X-rays. A reflection or an absorption of the supersonic waves takes place at such faulty positions, and correspondingly less sound energy is transmitted than at neighboring flawless points. If the workpiece is "tapped" with the sound ray, conclusions regarding nonhomogeneities within the body can be drawn from variations in the intensity of the diffraction spectra. The method and the equipment used are explained.

Testing of Workpieces by Supersonics. Fritz Kruse. (*Akustische Zeitschrift*, May, 1937, pp. 153–168.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2579.* 18 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.90.

The Physics of Adhesion. N. A. de Bruyne. *Journal of Scientific Instruments*, Vol. 24, No. 2, February, 1947, pp. 29–35, illus. 36 references.

The survey is concerned with solidifying adhesives. An examination of molecular considerations leads to the conclusion that wetting of the adherend by the adhesive is one of the necessary conditions for good adhesion. Wetting signifies strong molecular forces at the interface, and consideration of such surface forces leads to the conclusion that wood calls for hydrophilic or polar adhesives while rubber requires hydrophobic or nonpolar adhesives; in general, it appears to be impossible to make strong joints to polar adherends with a nonpolar adhesive and vice versa. In a study of the deformation and flow in a joint, attention is given to the residual strains in glass and metal seals and urea formaldehyde joints, the flow under clamping pressure, strains due to external forces, and variations of joint strength with overlap. Stress distribution is analyzed theoretically and experimentally.

Concerning Sensitized Phosphors. I. R. Tomaschek and P. Brauer. (*München, Technische Hochschule, Physikalisches Institut, ZWB/FB/RE/1695-1*, April 17, 1943.) *U.S., Army Air Forces, Translation No. F-TS-1807-RE*, February, 1947. 16 pp.

Experiments to Find a "Radiation" Effect of Excited Centers in Lead Sulfide Light-Resistors. H. Mueser. (*Prag, Deutsche Karls-Universität, ZWB/FEH/1008*, November, 1943.) *U.S., Army Air Forces, Translation No. F-TS-1841-RE*, February, 1947. 5 pp.

Properties of Optical Glass with Chemically Treated Surfaces. H. Schröder. (*ZWB/FB/1287*, September, 1940.) *U.S., Army Air Forces, Translation No. F-TS-1040-RE*, February, 1947. 17 pp., figs.

German Aircraft Paints. G. Palmer, A. Macmaster, and H. Hughes. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 365, Item No. 22.* 47 pp. British Information Services, New York. $1.45.

Materials—Metals and Alloys

Heat Resisting Alloys for Use in Jet-Propulsion Engines. J. W. Freeman. *University of Michigan.* (For abstract see "I.A.S. Briefs" on page 27 of this issue, May, 1947.)

Comparative Tests on Extruded 14S-T and Extruded 24S-T Hat-Shape Stiffener Sections. Marshall Holt and G. W. Feil. *U.S., N.A.C.A., Technical Note No. 1172*, March, 1947. 14 pp., illus. 5 references.

Tests were made with stiffened flat sheet panels having three hat-shape stiffeners. Two gages of sheet were used; one was 25 per cent thicker than the stiffeners and the other was 25 per cent thinner. This provided data that compared the strengths of the two alloys and showed the effect of sheet thickness on relative stiffener strengths. Full-section compressive tests were made on short lengths of the stiffeners of both alloys to determine the relative strength of the sections without any effect from sheet.

Bearing Strength of Some Sand-Cast Magnesium Alloys. R. L. Moore. *U.S., N.A.C.A., Technical Note No. 1136*, February, 1947. 18 pp., illus. 6 references.

Tests to determine the bearing strength of AM403, AM260, and AM265 cast magnesium alloys, and the relationship between bearing properties and tensile properties of the material. Data on compressive yield and ultimate strengths are included.

Elastic Properties in Tension and Shear of High Strength Nonferrous Metals and Stainless Steel—Effect of Previous Deformation and Heat Treatment. R. W. Mebs and D. J. McAdam, Jr. *U.S., N.A.C.A., Technical Note No. 1100*, March, 1947. 104 pp., figs. 30 references.

The rod materials tested in tension were nickel, Monel, Inconel, copper and 13-2 and 18-8 chrome nickel steel. Tubes tested in shear were made of nickel, Monel, and aluminum-Monel, while Inconel tubes were tested in both tension and shear. Experiments were made on the relationship between hysteresis and creep by repeated cyclic stressing with a constant load; five proof stresses were derived from corrected stress-set curves; secant modulus and variation stress were derived from corrected stress-strain curves, and the relationships were compared. The influence of annealing or tempering temperatures on the proof stresses and moduli was investigated and improvement of elastic strength generally was obtained. Variation of the proof stress and modulus of elasticity with plastic deformation or annealing temperature is explained, as well as the variation of Poisson's ratio with plastic deformation and annealing temperature.

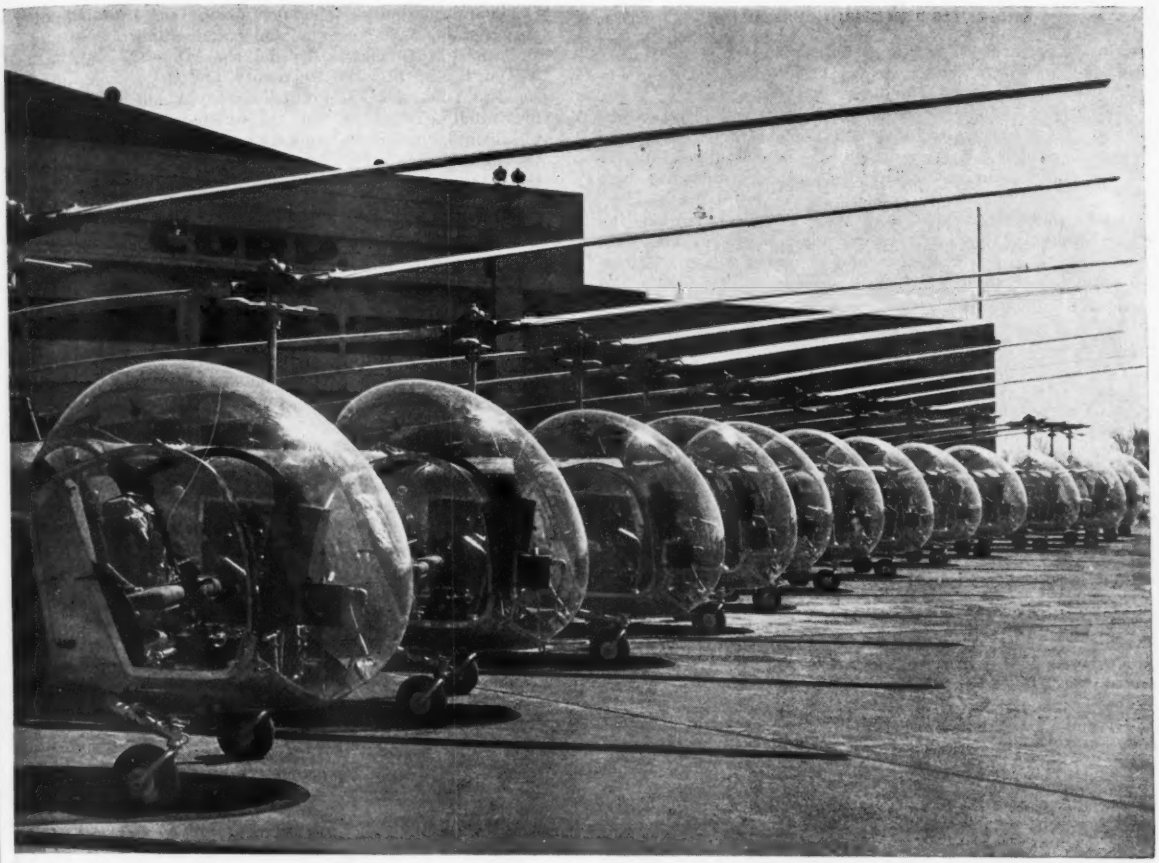
Data on Optimum Length, Shear Strength, and Tensile Strength of Age-Hardened 17S-T Machine-Countersunk Rivets in 75S-T Sheet. Evan H. Schuette and Donald E. Niles. *U.S., N.A.C.A., Technical Note No. 1205*, March, 1947. 41 pp., illus. 3 references.

Tests carried out with riveted joints constructed by the N.A.C.A. reverse-driving method of countersunk riveting indicated that such joints can be made satisfactorily with regard to both flushness and strength, if the ratio of buck to diameter of the rivet is kept between 0.9 and 1.5.

The Creep Strength of Nickel-Chromium-Cobalt and Iron-Chromium-Cobalt Alloys. Alfred Krisch. (*Düsseldorf, Kaiser-Wilhelm Institut für Eisenforschung, Mitteilungen*, Vol. 27, No. 1, 1944.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2567.* 20 pp., figs. 12 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $1.00.

Examples of Radiographic Examinations in Steel Foundry Technique. Heinz von Eckartsberg, Hubert Juretzek, and Wilhelm Mantel. (*Archiv für das Eisenhüttenwesen*, Vol. 12, No. 11, 1938-39, pp. 565–569.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2569.* 8 pp., figs. 3 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.40.

Observation on the screen is suitable only for detecting relatively large flaws in thin-walled objects. A distinction is drawn between local and general photographs. In general photographs difficulties result from the contrast effect and the appearance of secondary rays at the edges of the object. A method of photog-



Thirteen new Bell helicopters, designated YR-13A for the Army and HTL-1 for the Navy, ready for delivery at the Bell Aircraft Corporation plant.

raphy is discussed which is carried out with hard rays, the participating soft rays being filtered out by means of heavy metal foils before reaching the object.

Experiences with the Radiographic Examination of Magnesium Castings for Shop and Acceptance Inspection. A. H. F. Goederitz. (*Die Giesserei*, No. 10, 1941, pp. 217–224.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2565.* 11 pp., illus. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.55.

Six factors influence the definition of faults, namely, the low density of magnesium; nature and position of the fault; blurring of the image; lack of depth definition; radiation spectrum and intensity; and the quality of the light screen. Better results are obtained with weak rays. Stand equipment must be tested with the hot-wire focus meter for form and depth definition, and can then be greatly improved through alteration of focus, especially with tubes having large emission area. When the focal distance is roughly 1 to 1.20 meter in the stand and 2 to 3 in X-ray photography, less importance is attached to enlargement of the light spot by using high milliampere values to brighten the screen or reduce the exposure time. The fine-focus tube counteracts these faults by its point-shaped source of radiation. A line-focus tube also has given good results.

Developments in the German Iron and Steel Industry, Ruhr and Salzgitter Areas. T. P. Colclough. *Combined Intelligence Objectives Sub-Committee, Item No. 21, File No. 32-119.* 149 pp. British Information Services, New York. $3.65.

Use of 75ST in Structural Applications. George Snyder and Frank J. Crossland. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 11 pp., figs.

The Effect of Supersonic Waves on the Solidification of Molten Metals. S. Sokoloff. (*Elektro-Teknicheskii Institut*, Leningrad.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2568.* 4 pp., figs. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.20.

Intergranular Corrosion Determination. H. Kirtchik. *The Iron Age*, Vol. 159, No. 10, March 6, 1947, pp. 67–70, illus.

A cyclic test for this type of corrosion was developed in an effort to evaluate factors responsible for supercharger nozzle-box failures.

Materials—Plastics and Plywood

Static and Dynamic Creep Properties of Laminated Plastics for Various Types of Stress. Joseph Marin. *U.S., N.A.C.A., Technical Note No. 1105*, February, 1947. 64 pp., illus. 7 references.

For each type of test, the stress values of the five materials investigated ranged from zero stress to the ultimate strength. Static creep tests were made for tension, bending, and torsion, and the creep behavior was studied for fluctuating axial loads superimposed on static tensile loads. In general, the various kinds of creep tests showed that the creep deformation resistance varies with the ultimate tensile strengths of the laminates except for the torsion creep tests of square cross sections. In selecting the loads to be used for the creep tests it was first necessary to make control static tests in tension, compression, bending, and torsion. For these simple stress tests values of yield strength, ultimate strength, stiffness, and ductility were determined. It was found that the mechanical properties of a laminate for one type of simple stress are not always indicative of what the properties will be for another kind of stress.

The Effect of Intrinsic Compressive Stresses on Crazing and Strength Characteristics of Plexiglas M 33. H. Sigwart. (*Darmstadt, Technische Hochschule, ZWB/FB/1978*, August, 1944.) *U.S., Army Air Forces, Translation No. F-TS-1051-RE*, February, 1947. 22 pp., illus.

Tips on Designs in "Plexiglas." *Aero Digest*, Vol. 54, No. 3, March, 1947, pp. 74, 76, 116, figs.

Materials—Protective Coating

Marine Exposure Tests on Stainless Steel Sheet. Willard Mutchler. *U.S., N.A.C.A., Technical Note No. 1095*, February, 1947. 54 pp., illus. 17 references.

The principal objective of the study was to establish the relative resistance to corrosion of chromium-nickel alloys of the 18:8 type with and without small additions of columbium, molybdenum, and titanium as alloying elements. Tests also were conducted to obtain information on the effect of locality or exposure, of shot-welding, of various surface treatments and finishes, and of contact with dissimilar metals. The steels were in sheet form and of ten types with respect to nominal chemical compositions. The majority of the sheets were cold-rolled.

Medicine

The Application of Basic Physiologic Data in the Design of Respiratory Equipment. Loren D. Carlson and Verner J. Wulff. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 229–236, figs. 21 references.

Data on respiratory physiology are assembled and unified into general statements to be applied in the design of ventilating and high-altitude equipment. The varied and apparently independent data concerned with partial pressures of oxygen required for adequate arterial blood saturation, pulmonary ventilation, respiratory rate, human tolerable resistance to flow, and gas exchange in the lungs are collected and presented in a generalized framework.

The Physiology of Pressure Breathing. A. L. Barach, W. O. Fenn, E. B. Ferris, and C. F. Schmidt. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 73–87. 64 references.

Acceleration (G-Forces) Research Equipment, Studies, Results and Training. John G. B. Castor. *U.S., Army Air Forces, Intelligence Review No. F-IR-127-RE*, December, 1946. 107 pp., illus.

The information for this report was obtained through interrogation of Japanese personnel and examinations of centrifuge installations at Tachikawa Arsenal, the Army Medical College at Tokyo, Sendai Imperial University, and the Air Technical Arsenal at Yokosuka. The centrifuge equipment is described and illustrated in detail. Among the summaries of research accomplishments is included a translation of a report by Minoru Miura: On the Influence of Centrifugal Forces on the Intermediary Carbohydrate Metabolism (pp. 37–90), which contains a bibliography of 35 references.

Notes on Japanese Aviation Medicine and Research. Norman Molomut. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 64–68.

German Aircraft Oxygen Equipment. R. C. London and J. C. Gilson. *Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 318, Item Nos. 8, 22, 27.* 24 pp. British Information Services, New York. $0.90.

Aero Medical Experiences in China. Thomas C. Gentry. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 69–72.

The Effect of Binding of the Abdomen and Thorax on Pulmonary Lesions Produced by Explosive Decompression. W. V. Whitehorn, Allen Lein, and Fred A. Hitchcock. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 102–104. 4 references.

The Effect of Positive Radial Acceleration on the Intrarectal Pressure. R. F. Rushmer. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 96–101, 104, figs. 8 references.

Studies on Altitude Decompression Sickness. IV—Attempts to Avoid Decompression Sickness by Selection of Resistant Personnel. John S. Gray, H. S. Wigodsky, R. L. Masland, and Earl L. Green. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 88–95, tables. 1 reference.

The Frequency of Heterophorias and Their Influence on Stereoscopic Vision. H. Junker. (*Archiv für Ophthalmologie*, Vol. 142, 1940, pp. 367–888.) *Gt. Brit., Ministry of Supply,*

THE DOUGLAS SKYSTREAK
Equipped With Thompson Insulation

Propelled by America's most powerful jet. Designed to accomplish transonic speeds without sacrifice of ability to take off and land under its own power.

We are proud to have been entrusted with the responsibility of fabricating the Fiberglas Blankets that protect both pilot and plane as the Douglas Skystreak explores the sonic barrier.

Like so many of our jobs this was a special one carefully done to rigid specification. For full information on Thompson Thermo-Cousti or Refrasil high temperature insulation write . . .

THERMO-COUSTI

REFRASIL

THE H. I. THOMPSON CO.
Section 2-5 1733 Cordova St.
Los Angeles 7, Calif.

two recent
Wiley books
in aeronautics

Introduction to Aerodynamics of a Compressible Fluid
By Hans W. Liepmann
and Allen E. Puckett

This is the first broad and systematic study in English of compressibility effects in aerodynamics. Comprehensive in scope, clear and simple in detail, this pioneer work presents both fundamentals and more advanced theories.

1947 297 Pages $4.00

Matrix and Tensor Calculus
With Applications to Mechanics, Elasticity, and Aeronautics
By A. D. Michal

An authoritative book which gives a working knowledge of the fundamentals of matrix and tensor calculus and then develops them as tools for applications in various fields.

1947 132 Pages $3.00

Copies obtainable on approval
JOHN WILEY & SONS, INC.
440 Fourth Ave., New York 16, N.Y.

R.T.P. Translation No. 2586. 14 pp., figs. 8 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.70.

Electrocardiographic Changes in Fulminating Anoxia. Barry G. King and Margaret Henson. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 3–15, figs., Discussion, pp. 15–17. 19 references.

Aviation Medicine and Physical Standards for Airmen. W. R. Stovall. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 56–60, Discussion, pp. 60–63.

Study of the Relation Between Minnesota Multiphasic Personality Inventory Scores and "Pilot Error" in Aircraft Accidents. William D. O'Gorman and E. Charles Kunkle. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 31–38, tables. 16 references.

Safety—the AAF's Medical Goal. Malcolm C. Grow. *Air-Sea Safety*, Vol. 2, No. 3, March, 1947, pp. 38–41, illus.

The Motivations of the Flyer and His Reactions to the Stresses of Flight. R. C. Anderson. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 18–28, Discussion, pp. 28–30. 6 references.

Auditory Deterioration in Airline Pilots. Herbert Graebner. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 39–45, figs., Discussion, pp. 45–47.

Aerotitis Media; A Brief Presentation of Its Symptomatology, Prevention and Treatment. C. W. Shilling, H. L. Haines, J. D. Harris, and W. J. Kelly. *The Journal of Aviation Medicine*, Vol. 18, No. 1, February, 1947, pp. 48–54, figs., Discussion, pp. 54, 55. 11 references.

Meteorology

Preliminary Analysis of NACA Measurements of Atmospheric Turbulence Within a Thunderstorm—U.S. Weather Bureau Thunderstorm Project. Harold B. Tolefson. *U.S., N.A.C.A., Technical Note No. 1233*, March, 1947. 12 pp., illus. 3 references.

Some regions of thunderstorms may present no great hazard to flight, while exceptionally severe conditions of atmospheric turbulence may occur in other regions, or even in the same region, at about the same time. All thunderstorm flying is regarded as potentially dangerous until extremely turbulent regions within thunderstorms can be accurately predicted or detected.

Condensation Trails—Where They Occur and What Can Be Done About Them. Richard V. Rhode and H. A. Pearson. *U.S., N.A.C.A., Confidential Bulletin (Wartime Report No. L-474)*, September, 1942. 11 pp., figs.

FAWS (Flight Advisory Weather Service), U.S. Weather Bureau. C. Robert Elford. *Air-Sea Safety*, Vol. 2, No. 3, March, 1947, pp. 30–37, illus.

Visibility and Water Content in Clouds. Kampe. (*Ainring, Deutsche Forschungsanstalt für Segelflug, ZWB/UM/3541*, September 13, 1944.) *Mount Washington Observatory, Monthly Research Bulletin*, Vol. 2, No. 8, September, 1946. 23 pp., illus. 9 references.

Visibilities in clouds in the free atmosphere were determined in flight tests according to the visibility formula of Koschmieder. From the visibilities and the size of the drops of cloud species measured by Diem, the content of liquid water in these clouds is calculated by Trabert's formula. It is suggested that the same principle used for measuring the range of visible light may be applicable to the measurement of red light in clouds in the free atmosphere. A direct method for measuring the water content in clouds also is suggested.

An Example of Colloidal Instability of Clouds in Tropical Latitudes. W. J. Kotsch. *American Meteorological Society, Bulletin*, Vol. 28, No. 2, February, 1947, pp. 87–89, figs. 6 references.

Tracking Ocean Storms with the Seismograph. Marion H. Gilmore. *American Meteorological Society, Bulletin*, Vol. 28, No. 2, February, 1947, pp. 73–86, figs.

Wartime Activities of the Australian Meteorological Service (R.A.A.F.). H. N. Warren. *American Meteorological Society, Bulletin*, Vol. 28, No. 2, February, 1947, pp. 69–72, figs.

On the Distribution of Angular Velocity in Gaseous Envelopes under the Influence of Large-Scale Horizontal Mixing Processes. C.-G. Rossby. *American Meteorological Society, Bulletin*, Vol. 28, No. 2, February, 1947, pp. 53–65, figs. 11 references.

Stratus Ceilings at San Francisco Airport During the Summer Season. H. C. Steffan and J. H. Morgan. *Journal of Aeronautical Meteorology*, Vol. 2, No. 4-5, July-October, 1946, pp. 105–113, figs. 10 references.

The North American FJ-1 jet fighter designed for the U.S. Navy.

Data important in the rapid evaluation of a synoptic situation with respect to the occurrence of a ceiling at this airport are presented.

An Investigation into Advection-Radiation Fog and Stratus at Houston, Texas. J. T. Hilworth. *Journal of Aeronautical Meteorology*, Vol. 2, No. 4-5, July-October, 1946, pp. 93–104, figs. 3 references.

A previous study of low ceilings and fog at Houston was tested for its usefulness and found to lead to forecasts above average. Tests of certain improvements on the techniques of making the forecast also were carried out.

A Study of Local Weather Conditions and Their Forecasting at Pittsburgh Airport. J. J. George and M. W. Ellett. *Journal of Aeronautical Meteorology*, Vol. 2, No. 4-5, July-October, 1946, pp. 114–123, figs.

Military Aviation

Remote Control System Built by Askania for Bomber Gun Turrets. Charles R. Wieser. *Combined Intelligence Objectives Sub-Committee, Item Nos. 2, 9, 27, File No. 32-54.* 46 pp., illus. British Information Services, New York. $1.45.

Telescopic Sight ZFR3A (for the Aiming of Fixed Aircraft Guns). (*E. Leitz G.m.b.H.*, October, 1943.) *U.S., Army Air Forces, Translation No. F-TS-787-RE*, February, 1947. 11 pp., figs.

German Aircraft and Anti-Aircraft Gunnery Training Targets. L. H. Glassman and H. D. Blanchard. *Combined Intelligence Objectives Sub-Committee, Item No. 2, File No. 32-117*, August, 1945. 9 pp., figs. British Information Services, New York. $0.35.

Photometric Procedures Used in Research and Production of German Pyrotechnic Ammunition. Henry J. Eppig. *Combined Intelligence Objectives Sub-Committee, Item Nos. 3, 17, File No. 32-1.* 11 pp., figs. British Information Services, New York. $0.70.

Navigation

Automatic Aircraft Position Plotters. W. L. Webb and A. C. Omberg. *Radio News*, Vol. 37, No. 4, April, 1947, Radio Electronic Engineering Dept., pp. 3–5, 31, illus. 1 reference.

Descriptions and schematic circuit diagrams of instruments under study by the Bendix Radio Div. of Bendix Aviation Corporation: systems using two angles as data (a polar coordinate plotter and rectangular coordinate plotters), systems using two distances, and systems employing two differences in distance.

Parachutes

Parachutes and Parachute Materials Used in Germany. B. A. Holgate. *U.S., Field Information Agency, Technical, Final Report No. 465*, November 8, 1945. 11 pp. British Information

As simply as this

they lick a high-temperature problem

FINDING a packing to seal the exhaust manifolds of aircraft engines *used* to be quite a problem.

Corrosive, flaming gases quickly charred ordinary substances. While materials that could endure the heat, soon disintegrated under the incessant vibration.

But . . . Johns-Manville engineers found a material (*and a method of using it*) to tame this triple threat of heat, corrosion and vibration.

Logically enough, they chose a material known for its great thermal endurance . . . *Inconel.* *

They had thin strands of this INCO Nickel Alloy knit into mesh and then tightly braided around an asbestos coil. *Result:* a J-M packing that stubbornly resists the searing attack of hot, corrosive gases.

Packings are but one of the many ways Inconel can help safeguard air travel. Containing 80 per cent nickel and 14 per cent chromium, Inconel gives you superior resistance to heat . . . corrosion . . . oxidation . . . stress.

Inconel is readily available in all standard mill forms — plate, strip, rod, tubing, wire, screening — to be fabricated into your design. (*Frequently, a switch to longer-lasting Inconel means a simpler, lighter design.*)

Remember, if your problem is high temperatures . . . your best bet probably is use of Inconel. *Make it "first" in any investigation!*

Send for your copy of "ENGINEERING PROPERTIES OF INCONEL."

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK 5, N. Y.

NICKEL (INCO TRADE MARK) ALLOYS

MONEL* • "K"* MONEL • "R"* MONEL • "KR"* MONEL • "S"* MONEL • INCONEL* • NICKEL • "L"* NICKEL • "Z"* NICKEL

*Reg. U. S. Pat. Off.

INCONEL MESH and INCONEL MESH-ASBESTOS PACKINGS, as illustrated above, are available from JOHNS-MANVILLE, 22 East 40th St., N. Y. C., in coil and tape form in various sizes.

Services, New York. $0.55. Includes details of the ribbon-type and the guiding-surface type parachutes.

Production—General

Report on Administration, Plastics, Production Tooling, Spare Parts, and Servicing in German Aircraft Industry. Sherman S. Cross, Raymond E. Elliott, and others. *Combined Intelligence Objectives Sub-Committee, Item No. 25, File No. 30-94.* 62 pp., illus. British Information Services, New York. $1.75.

Underground Factories in Central Germany. W. R. J. Cook, T. R. B. Saunders, and others. *Combined Intelligence Objectives Sub-Committee, Item Nos. 4, 5, 25, 30, File No. 32-17.* 154 pp., illus. British Information Services, New York. $4.65.

Production Methods

Lofting and Template Reproduction. S. P. Woodley. *The Royal Aeronautical Society, Journal,* Vol. 51, No. 435, March, 1947, pp. 306–324, Discussion, pp. 324–328. (Cf. AER 3/47:77.)

Practical Aspects of Surface Measurement Instrumentation. James A. Broadston. *The Iron Age,* Vol. 159, No. 12, March 20, 1947, pp. 51–55, illus.

The development of surface finish control is reviewed and its practical application is discussed. Instruments for measuring and controlling surface finish are described. Comments are made on the effectiveness and cost of the process.

Production Tools and Equipment

German Airframe Tooling—General. R. G. Bowen, S. S. Cross, Ray Elliott, Palmer Nicholls, and Henry Stienmeier. *U.S., Field Information Agency, Technical, Final Report No. 100,* October 4, 1945. 8 pp., figs. British Information Services, New York. $0.35.

Portable Equipment for Industrial Radiology. E. A. W. Müller. (*Elektrotechnische Zeitschrift,* Vol. 62, No. 12, March 20, 1941, pp. 305–308.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 2589.* 8 pp., illus. 8 references. Durand Reprinting Committee, California Institute of Technology, Pasadena. $0.40.

Wiring-diagrams for X-ray appliances, tubes, and instruments for two-pole operation are described. The single pole earthed apparatus for operating hollow anodes and, in particular, fine focus tubes are considered. Reference is made to radiometers with direct indication for the measurement of wall thickness, to dosimeters, counting tube apparatus, and apparatus for measuring ray-protection.

Propellers

A Preliminary Study of a Propeller Powered by Gas Jets Issuing from the Blade Tips. J. C. Sanders and N. D. Sanders. *U.S., N.A.C.A., Technical Note No. 1155,* November, 1946. 20 pp., figs. 4 references.

Air is drawn through the hub and passes through the hollow propeller blades to the tips, where burners heat the air and expel it through the nozzles in the blade tips. The reaction of the jets rotates the propeller. Computations are made of the performance of a propeller designed to develop 56 thrust hp. at 100 m.p.h. The fuel consumption of a jet-operated propeller would be considerably higher than that of a reciprocating engine and a propeller. The lighter weight of the jet-operated propeller will result in a lighter weight of engine plus fuel for short-range flights. For long-range flights, the weight of the jet-operated propeller with its fuel would be greater than the weight of a reciprocating engine with its propeller and fuel.

Effect of Slipstream Rotation in Producing Asymmetric Forces on a Fuselage. Herbert S. Ribner and Robert MacLachlan. *U.S., N.A.C.A., Technical Note No. 1210,* March, 1947. 31 pp., illus. 4 references.

An approximate theory of the effect of slipstream rotation on the forces on a fuselage without a wing represents the slipstream rotation by the flow about a vortex aligned with the longitudinal axis. This configuration gives rise to a lateral force and yawing moment in pitch or a normal force and pitching moment in yaw. The forces are proportional to angle of inclination and to slipstream rotation as measured by the ratio of propeller torque to the square of the diameter. A wind-tunnel model was tested alone and in combination with each of six 4-blade propellers of different diameter and blade angle. The measurements were made in pitch, and a lateral force was found with a magnitude of the order of the theoretic value.

Effect of Centrifugal Force on the Elastic Curve of a Vibrating Cantilever Beam. Scott H. Simpkinson, Laurel J. Eatherton, and Morton B. Millenson. *U.S., N.A.C.A., Technical Note No. 1204,* February, 1947. 22 pp., illus. 5 references.

The theoretic analysis was confined to uniform cantilever beams; the experimental work was extended to include a tapered cantilever to simulate an aircraft propeller blade. Calculations were made on a nondimensional basis for second- and third-mode vibration; the experiments were carried out on beams of various lengths, materials, and cross sections for second-mode vibration. High vibratory-stress positions are unaffected by the addition of centrifugal force at rotary speeds as high as 100 per cent above the normal operating speed range of present aeronautical equipment. Nonrotating vibration surveys of blades therefore are valuable in predicting high vibratory-stress locations under operating conditions.

Flight Measurements of Compressibility Effects on a Three-Blade Thin Clark Y Propeller Operating at Constant Advance-Diameter Ratio and Blade Angle. A. W. Vogeley. *U.S., N.A.C.A., Advance Confidential Report No. 3G12 (Wartime Report No. L-505),* July, 1943. 23 pp., figs. 1 reference.

On the Vortex Sound from Rotating Rods. E. Y. Yudin. (*Zhurnal Tekhnicheskoi Fiziki* (U.S.S.R.), Vol. 14, No. 9, 1944.) *U.S., N.A.C.A., Technical Memorandum No. 1136,* March, 1947. 13 pp., figs. 10 references.

The motion of bodies immersed in liquid or gaseous media may be accompanied by a characteristic sound which is excited by the formation of unstable surfaces of separation behind the body, usually disintegrating into a system of discrete vortexes, such as the von Kármán vortex street due to the flow around an infinitely long rod. Vortex noise frequently predominates in the sound from propellers, fans, pumps, and similar machinery. The work was undertaken to clarify certain questions about the dependence of that sound upon the aerodynamic parameters and the tip speed of the rotating rods or blades. Although insufficient data were obtained to calculate the first rough approximation to the solution, certain conclusions may be found applicable for the reduction of noise from rotating blades.

Kinetic Heating Effects on Propeller Icing. John L. Orr *Journal of Aeronautical Meteorology,* Vol. 2, No. 4-5, July-October, 1946, pp. 124–127, fig. 5 references.

A study of experimental data obtained during flight tests under natural icing conditions carried out by the National Research Council of Canada over the past 5 years shows that the actual kinetic temperature rise on aircraft propeller blades under icing conditions is considerably less than that indicated by the theory of M. Gershzohn. This kinetic heating effect is inadequate to prevent ice formation over the normal range of conditions under which icing is encountered.

German Manufacture of Airscrews by the Vereinigte Deutsche Metallwerke Organisation. Harold Davies. *Combined Intelligence Objectives Sub-Committee, Item No. 26, File No. 12-6.* 21 pp. British Information Services, New York. $0.70.

Radio

Electrostatic Ills and Cures of Aircraft. I—Electrification of Airplanes and How It Causes Radio Interference. Robin Beach. *Electrical Engineering,* Vol. 66, No. 4, April, 1947, pp. 325–334, illus. 12 references.

The manner in which airplanes in flight become electrically charged are classified into two general categories—contact agencies and electrostatic induction agencies. Consideration is given to the mechanism by which radio interference is produced. It is concluded that sparks across insulators and ionized leaders from sharp points and edges on airplane structures are the essential causes of parasitic radiations that give rise to radio interference.

A Contribution to the Received Field Strength as a Function of Altitude. G. Sudeck. (*Deutsche Versuchsanstalt für Luftfahrt, ZWB/FB/RE/547,* March, 1936.) *U.S., Army Air Forces, Translation No. F-TS-971-RE,* February, 1947. 10 pp., figs. 4 references.

The results of flight tests are in good agreement with those known so far, and extend the frequency and distance range of such

The Navy's XRP-1 transport and rescue helicopter, designed and built by Piasecki Helicopter Corporation, can take off vertically with more than 1 ton of useful load and accelerate to speeds of 100 m.p.h. The tandem rotors are powered by a single 600-hp. Pratt & Whitney engine.

tests. The field strength at waves below 500 m. is shown to be strongly dependent upon the flight altitude.

Questions Concerning Different Radar Systems. G. Guanella. *Interavia*, Vol. 1, No. 8-9, November-December, 1946, pp. 48–54, illus. 9 references.

An analysis and comparison of the pulse and beat methods used in a reflection beam system for determining the range or bearing of distant objects.

Research

Australian Research in Aeronautics. Alexander Klemin. *Interavia*, Vol. 1, No. 8-9, November-December, 1946, pp. 55–58, illus.

Engineering and Research Planning of the Army Air Forces. L. C. Craigie. *Preprint, S.A.E. Annual Meeting*, Detroit, January 6–10, 1947. 19 pp

Rotating Wing Aircraft

Charts Showing Relations Among Primary Aerodynamic Variables for Helicopter-Performance Estimation. Herbert W. Talkin. *U.S., N.A.C.A., Technical Note No. 1192*, February, 1947. 51 pp., figs. 3 references.

The charts show the relations among the aerodynamic variables and the variation of these relations with rotor-blade-element lift coefficient and rotor-blade-element profile-drag coefficients, excluding the determination of the profile-drag coefficient of the blade under flight conditions. The data apply directly to helicopters with a single three-bladed lifting rotor and give typical results, trends, and limits of helicopter performance. Performance conditions considered include hovering, horizontal flight, climb, and ceiling. Special problems discussed include vertical climb and the use of rotor-speed-reduction gears for hovering.

Theory of Self-Excited Mechanical Oscillations of Hinged Rotor Blades. Robert P. Coleman. *U.S., N.A.C.A., Advance Restricted Report No. 3G29 (Wartime Report No. L-308)*, July, 1943. 31 pp., figs. 5 references.

Helicopter Theory; Interview with Dr. Kurt Hohenemser Concerning His Recent Contributions. Bartram Kelley and Hugh J. Mulvey. *U.S., Field Information Agency, Technical, Final Report No. 177*, October 1, 1945. 5 pp. British Information Services, New York. $0.35

A Method of Ground Resonance Testing for Helicopters. *Society of Automotive Engineers, Aeronautical Information Report No. 12*, September 1, 1946. 7 pp., illus. $0.25.

A tie-down rig, consisting of a rigid framework or a cable system, is used for a systematic investigation, over the range of possible rotor speeds, of incipient resonance initiated by external excitation of the rotor hub. A complete analysis of rotor system vibration and of the natural frequencies of the rotor craft components should precede the tie-down test.

Desirable Characteristics for Helicopter Engines. *Society of Automotive Engineers, Aeronautical Information Report No. 16*, February 1, 1947. 3 pp. $0.25.

Consideration is given to power-speed relations, applied loads, cooling, life expectancy, and the supplying of operating and overhaul instructions by the manufacturer.

Preliminary Testing of Helicopter Transmissions and Design Life of Helicopter Transmissions. *Society of Automotive Engineers, Aeronautical Information Report No. 14*, February 1, 1947. 6 pp. $0.25.

An outline of recommended procedures for carrying out static deflection tests, dynamic tests at slow speeds to determine deflection characteristics, no-load-rotational tests to determine lubricating characteristics, and dynamic endurance tests at normal loads and speeds.

Desired Characteristics for Helicopter Wheels, Tires and Brakes. *Society of Automotive Engineers, Aeronautical Information Report No. 15*, February 1, 1947. 3 pp. $0.25.

Rotor Blade Production. John T. Parsons. *Aero Digest*, Vol. 54, No. 3, March, 1947, pp. 73, 132–134, illus.

Production methods and techniques developed by the Traverse Bay Manufacturing Company for the manufacture of step-tapered spar blades for the Sikorsky R-5 helicopter are described.

Helicopter Power Plant Installations. Robert A. Wolf and Carl P. Spiesz. *Preprint, S.A.E. National Aeronautic Meeting (Spring)*, New York, April 9–11, 1947. 12 pp., figs.

Chief consideration is given to those problems of piston-engine power-plant installations which are generic to the helicopter and differ from the more common experiences of fixed-wing aircraft. Data based on the experience of the Bell Aircraft Corporation during the past 5 years in the development of eight different helicopters utilizing six different power plants are presented.

Focke-Achgelis Rotary Wing Kite (Division of Weser Flugzeugwerke). H. E. Weihmiller and H. P. Meiners. *U.S., Field Information Agency, Technical, Final Report No. 176*, October 1, 1945. 10 pp., figs. British Information Services, New York. $0.35.

Historical Development of Helicopters. II. R. N. Liptrot. *American Helicopter*, Vol. 6, No. 4, March, 1947, pp. 12–14, 24–27, illus. (Cf. AER 4/47:66.)

Regulatory Problems Facing the Helicopter Industry. L. Welch Pogue. *Paper presented at the American Helicopter Society 3rd Annual Forum*, Philadelphia, March 28, 1947. 14 pp.

Broad principles for the establishment of helicopter regulation are outlined, emphasizing that the regulations pertaining to conventional aircraft should not be applied, in many instances, to helicopters and their operation.

Seaplanes and Flying Boats

Bibliography and Review of Information Relating to the Hydrodynamics of Seaplanes. James M. Benson and Jerold M. Bidwell. *U.S., N.A.C.A., Advance Confidential Report No. L5G28 (Wartime Report No. L-230)*, September, 1945. 83 pp., figs. 266 references.

Data and conclusions obtained from the references in the bibliography have been correlated to present in qualitative form a summary of the status of knowledge pertaining to the hydrodynamics of seaplanes and to point out the need for further research. Characteristics of conventional hulls and floats are discussed to show the effects upon performance of changes in design parameters such as dead rise, depth of step, and angle of afterbody keel. A separate section is devoted to special problems relating to floats for seaplanes. Other topics discussed include lateral stabilizers, aerodynamic and propulsive considerations, unconventional configurations, hydrofoils, and piloting and handling.

A Collection of the Collapsed Results of General Tank Tests of Miscellaneous Flying-Boat-Hull Models. F. W. S. Locke, Jr. *U.S., N.A.C.A., Technical Note No. 1182*, March, 1947. 117 pp., figs. 9 references.

Summary charts are presented of tests on about 100 models and represent the results of all the published N.A.C.A. general tank tests, as well as some from the Stevens Institute of Technology and Royal Aircraft Establishment tanks, in such form that they will be of immediate usefulness for design purposes. All the data for any one model are presented on a single summary chart which may be used to make either specific or general comparisons. Some generalizations are put forward on the various methods in which the charts may be used.

Impact Loads on Seaplanes During Landing, with Particular Reference to the Influence of the Forward Speed. F. J. Plantema. *Netherlands, Nationaal Luchtvaartlaboratorium, Report No. S.317*, January 10, 1947. 11 pp., figs. 6 references. (In English.)

The general equations for the water reaction on alighting seaplanes are developed under certain simplifying assumptions. An increase of the forward speed causes a considerable increase of the maximum water reaction, providing other variables remain unchanged. This increase may be reduced to a large extent by curving the bottom immediately forward of the step. The results of the load-factor calculations are shown for a particular seaplane, where an increase of the forward speed is accompanied by a decrease of the trim angle and by a change of the speed of descent. Except at low descent speeds, the loads on normal curved bottoms are much larger than on V-bottoms of equal volume. To obtain reduced maximum water reaction, bottoms with a reversed curvature could be employed. Increase in the size of the airplane reduces the load factor. Several cases are considered showing varying reduction of the load factor and the results of other numerical calculations.

Flying Boat Problems Related to Production, Controls and Pressurisation. C. P. T. Lipscomb. *The Royal Aeronautical Society, Journal*, Vol. 51, No. 434, February, 1947, pp. 132–140, Discussion, pp. 140–144.

Considers cabin pressurization, silencing, turbine-engine installation, simplification of production by proper design, and the structural problems involved in the manufacture of the Short Shetland flying boat.

Tank Investigation of a Powered Dynamic Model of a Large Long-Range Flying Boat—Langley Tank Model 180. John B. Parkinson, Roland E. Olson, and Marvin I. Haar. *U.S., N.A.C.A., Technical Note No. 1237*, March, 1947. 47 pp., illus. 5 references.

Aerodynamic and hydrodynamic tests were made of a $^1/_{12}$-size powered dynamic model of a four-engined transport flying boat of 165,000 lbs. design gross load. Landing stability was satisfactory with a depth of step of 9 per cent beam at the centroid; the hydrodynamic center-of-gravity range for stable take-offs was satisfactory as to extent and position with respect to the stable flight range desired; the take-off performance was satisfactory for the power loading assumed; the relation of the proportions to the design loading of the hull was correct for satisfactory spray characteristics; and large overloads were possible with relatively simple spray-control devices.

Stress Analysis and Structures

Note on Stresses in a Wing or Fuselage with Buckled Skin. H. L. Langhaar. *Consolidated Vultee Aircraft Corp.* (For abstract see "I.A.S. Briefs" on page 27 of this issue, May, 1947.)

Stresses in Cylindrical Semimonocoque Open Beams. Henry L. Langhaar and Clarence R. Smith. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 211–220, figs. 3 references.

The theory of open, symmetric, semimonocoque beams of circular-cylindrical shape is developed by direct minimizing of the strain energy in a length of open beam whose ends are acted upon by specified resultant forces and moments. Simple explicit formulas are obtained for the stresses. The theory exhibits exponential stress gradients near the longerons—an effect that has not heretofore been incorporated in the analyses of open beams. This phenomenon may cause high axial stresses at the corners of a cutout in a cylindrical beam and high shearing stresses near the longerons. Experimental data are presented which tend to confirm these conclusions.

Shear Distribution due to Twist in a Cylindrical Fuselage with a Cutout. M. M. Gololobov. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 253–256, figs.

Equations are developed by which the shear forces due to torsion and the additional axial forces in the stringers can be calculated. A numerical example is solved to find the shear distribution in the parts of the fuselage adjacent to the cutout, from which can be calculated the axial force in each stringer from the difference of the shears at both sides of it.

The General Theory of Cylindrical and Conical Tubes Under Torsion and Bending Loads. I. J. Hadji-Argyris and P. C. Dunne. *The Royal Aeronautical Society, Journal*, Vol. 51, No. 434, February, 1947, pp. 199–269, figs.

A rational method of stressing single or many-cell tubes, particularly of the type encountered in wing structures, is presented. The theory is developed for conical or cylindrical tubes of arbitrary cross section the shape of which is maintained by a closely spaced system of diaphragms rigid in their own planes and parallel to the root section. Within the limits of the assumptions the theory is exact for right cylindrical tubes, and is applicable with adequate accuracy to cylindrical or conical tubes in which the inclination of any generator to the normal to the root plane does not exceed 10°.

The Stresses in Cylindrical Vessels. H. D. Conway. *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 52–54, figs.

Using the general theory of cylindrical shells, expressions have been derived for the maximum bending moment and shearing force in vessels closed at one end and subjected internally to (a) gas pressure, (b) hydrostatic pressure. The method has been used by Timoshenko for the special case where one end of the vessel is built into a rigid foundation. Graphs are given whereby the maximum bending moment and shearing force can be found for any cylindrical vessel subjected to gas or hydrostatic pressure. Numerical examples are given.

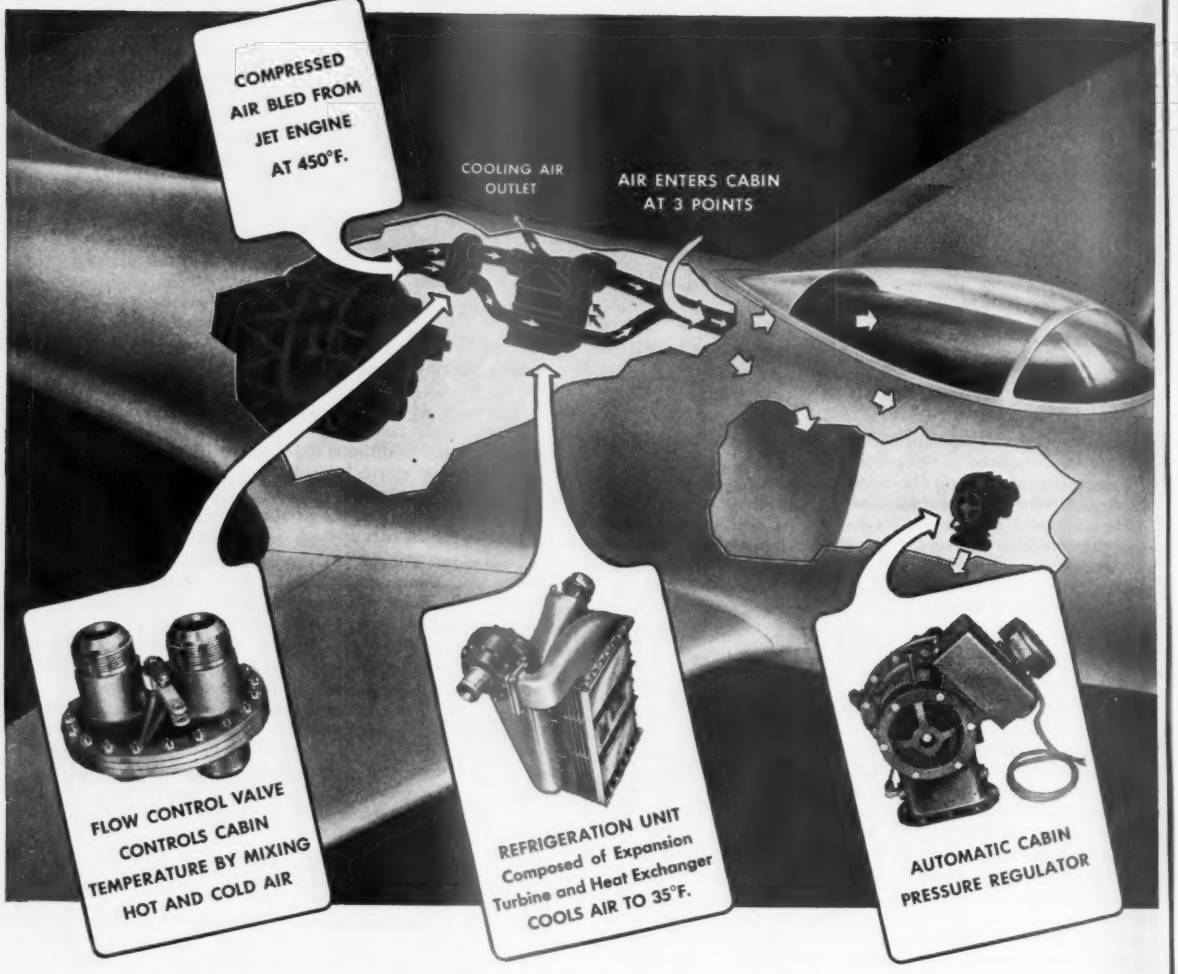
Bending of Clamped Plates. W. B. Stiles. *Journal of Applied Mechanics*, Vol. 14, No. 1, March, 1947, pp. A-55–A-62, figs. 6 references.

The exact solution for thin rectangular plates clamped on all or part of the boundary requires the solution of two infinite sets of simultaneous equations in two sets of unknowns. A method of obtaining an approximate solution based upon minimization of energy is described. The approximation functions are derived from functions representing the normal modes of a freely vibrating membrane for the same region. Solutions are obtained for a rectangular clamped plate supporting a uniform or a central-point load, and for a square plate clamped on two adjacent edges and pinned on the other two edges with either a uniform or a central-point load. Analytic results are compared with experimentally determined deflections and stresses.

Determination of the Natural Frequencies of the Bending Vibrations of Beams. A. I. Bellin. *Journal of Applied Mechanics*, Vol. 14, No. 1, March, 1947, pp. A-1–A-6, figs. 8 references.

The beams may be of variable cross section and may have any number of spans. The five-moment equation is developed and is then applied to beams supported in various ways. The necessary calculations are reduced to a simple tabular scheme. Several examples demonstrate the method of computation.

"Cabin Comfort" for Jet Fighters


COMPRESSED AIR BLED FROM JET ENGINE AT 450°F.
COOLING AIR OUTLET
AIR ENTERS CABIN AT 3 POINTS
FLOW CONTROL VALVE CONTROLS CABIN TEMPERATURE BY MIXING HOT AND COLD AIR
REFRIGERATION UNIT Composed of Expansion Turbine and Heat Exchanger COOLS AIR TO 35°F.
AUTOMATIC CABIN PRESSURE REGULATOR

AiResearch provides full, automatic control of cockpit pressure and temperature

A difficult problem in air conditioning is inherent in jet airplanes . . . it is that of controlling the heat caused by compression and high speed. Operating at high altitudes, the planes must be pressurized, but the only compressed air available comes directly from the jet engines — at temperatures above 400°F. Added to this is the great heat generated in the fuselage by air friction due to high speed. Before this hot, compressed air reaches the cockpit, it must be cooled to as low as 35°F.

With "Cabin Comfort" systems, including pressurization and cooling, AiResearch solves this and other problems of air conditioning for designers of all types of new airplanes. All parts, controls and accessories are provided for complete installations.

AiResearch leadership in aircraft *air control* is backed by seven years of pioneering research and production. Call upon this unique background to solve your AIRCRAFT air conditioning problems. AiResearch Manufacturing Company, Los Angeles 45, California.

MIDGET TURBINE ALONE COOLS AIR 140°F.

Revolutionary development in the jet fighter "Cabin Comfort" system is the 3-lb. AiResearch expansion turbine. Operating at speeds up to 100,000 RPM, it cools air 140°F. at 7 lbs. airflow per minute. Another AiResearch *first!*

• *AiResearch "Cabin Comfort" equipment conditions the newest Lockheed Constellation and new planes of Consolidated Vultee, Douglas, Martin, Republic and Northrop.*

AiResearch
DIVISION OF
THE GARRETT CORPORATION

Sales Representatives: NEW YORK, Aero Engineering, Inc., Room 1014, 160 Broadway ☆ SEATTLE, C & H Supply Co., 2723 First Avenue South ☆ WICHITA, N. S. Chapin, 815 East Gilbert

Observations on the Behavior of Some Noncircular Aluminum Alloy Sections Loaded to Failure in Torsion. R. L. Moore. *U.S., N.A.C.A., Technical Note No. 1097*, February, 1947. 47 pp., illus. 12 references.

Tests were carried out on rectangular bars of several proportions and on square, rectangular, and streamlined tubing. Within the elastic range it was shown that torsional stiffness and maximum shearing stresses could be predicted closely by means of existing formulas. First, yield and ultimate strengths in torsion were shown to be a function of either the shearing properties of the materials or the shear-buckling resistance of the tube walls. Approximate methods of evaluating these strengths for rectangular bars and tubular sections were indicated. A second series of tests was carried out with a cruciform and an I-section in which, as before, shearing stresses were of principal importance. Several extruded flanged members of I, Z, and channel section were included in which significant longitudinal stresses also were developed.

Experimental Investigation of the Stress Distribution Around Reinforced Circular Cut-Outs in Skin-Stringer Panels under Axial Loads. Daniel Farb. *U.S., N.A.C.A., Technical Note No. 1241*, March, 1947. 21 pp., illus. 1 reference.

The surveys were made in the elastic range. In each case the reinforcing rings were of rectangular cross section, and the cross-sectional area of the reinforcement approximately equaled the cross-sectional area of the skin and stringers removed at the transverse centerline of the cutout. Curves are presented which show the distribution of stringer and shear stresses in the panel and bending stresses in the reinforced rings. Empiric methods are given for estimating the maximum stringer stress in the panel and for approximating the longitudinal stresses in the stringers and rings at the transverse center line of the cutout.

On New Quartz Pressure-Measuring Cells for the Piezo-electric Measuring Method. I. S. Fahrenthols, J. Kenge, and H. E. Linckh. (*Physikalische Zeitschrift*, Vol. 3, 1932, pp. 73–78.) *Gt. Brit., Ministry of Supply, R.T.P. Translation No. 3108.* 7 pp., figs. 2 references.

The principles of newly developed pressure-measuring cells that are insensitive to accelerations acting on the cells and are characterized by high natural frequency and simple construction.

Stress Analysis by Recurrence Formula of Reinforced Circular Cylinders under Lateral Loads. John E. Duberg and Joseph Kempner. *U.S., N.A.C.A., Technical Note No. 1219*, March, 1947. 44 pp., figs. 8 references.

A recurrence formula is developed for the stress analysis of reinforced circular cylinders loaded in the planes of their rings. Deformations of rings and sheet are considered. The recurrence formula, in conjunction with appropriate boundary equations, can be used to obtain sets of simultaneous linear algebraic equations. The solutions of these equations enable the stress analyst to find the shear flows and direct stresses in the sheet, as well as the shear forces, axial forces, and bending moments in the rings. In order to reduce the amount of computation involved in the stress analysis of relatively long reinforced cylinders, an approximate method of analysis is presented. In this method the cylinder under consideration is assumed to be infinitely long, and the recurrence formula is treated as a fourth-order finite-difference equation. It is recommended that the approximate solution be utilized for the stress analysis of cylinders loaded at rings located two or more bays from external restraints.

Device for Measuring Principal Curvatures and Principal Strains on a Nearly Plane Surface. A. E. McPherson. *U.S., N.A.C.A., Technical Note No. 1137*, February, 1947. 22 pp., illus. 4 references.

The principal extreme fiber bending strains over a circular area having a radius of 0.94 in. can be measured with a systematic error on 0.1-in. sheet of the order of ± 0.00003. The device requires a Tuckerman autocollimator to measure curvatures along three lines 120° apart and three 1-in. Tuckerman strain gages to measure strains along three other lines 120° apart. Equations are presented for computing median fiber strains from the measured curvatures and strains at the surface and from the thickness of the sheet.

Buckling Stresses of Simply Supported Rectangular Flat Plates in Shear. Manuel Stein and John Neff. *U.S., N.A.C.A., Technical Note No. 1222*, March, 1947. 13 pp., figs. 3 references.

The stresses were determined with greater accuracy than in previous work by considering both the symmetric (odd number of buckles) and antisymmetric (even number of buckles) buckle patterns. Through the matrix iteration method and by a proper choice of the terms in the series representing the deflection, more accurate results were obtained. A curve is presented from which the critical stresses may be obtained when the dimensions of the plate are known.

Critical Combinations of Shear and Direct Stress for Simply Supported Rectangular Flat Plates. S. B. Batdorf and Manuel Stein. *U.S., N.A.C.A., Technical Note No. 1223*, March, 1947. 29 pp., figs. 8 references.

The buckling of a simply supported rectangular flat plate under combinations of shear and direct stress was investigated by means of an energy method. The critical combinations of stress for several length-width ratios were determined to an accuracy of about 1 per cent by the use of tenth-order determinants in conjunction with a modified matrix iteration method. Curves were drawn which can be used to obtain the critical stress combinations for the case of interaction of shear and longitudinal direct stress and for the case of interaction of shear and transverse direct stress.

Test Data on the Shear Strength of Machine Countersunk-Riveted Joints Assembled by an NACA Flush-Riveting Procedure. Robert Gottlieb. *U.S., N.A.C.A., Restricted Bulletin (Wartime Report No. L-523)*, December, 1942. 28 pp., figs. 4 references.

Tests of 10-Inch 24S-T Aluminum-Alloy Shear Panels with $1^1/_2$-Inch Holes. II—Panels Having Holes with Notched Edges. Paul Kuhn and L. Ross Levin. *U.S., N.A.C.A., Restricted Bulletin No. L4D01 (Wartime Report No. L-512)*, April, 1944. 8 pp., figs. 1 reference.

Critical Shear Stress of an Infinitely Long Flat Plate with Equal Elastic Restraints Against Rotation along the Parallel Edges. Elbridge Z. Stowell. *U.S., N.A.C.A., Advance Restricted Report No. 3K12 (Wartime Report No. L-476)*, November, 1943. 26 pp., figs. 8 references.

Shear Tests on du Pont Explosive Rivets with the Countersunk Head Milled Flush after Expansion. Robert Gottlieb and Leonard M. Bartone. *U.S., N.A.C.A., Restricted Bulletin No. 3E06 (Wartime Report No. L-393)*, May, 1943. 5 pp., figs. 4 references.

Radiography and the Fatigue Strength of Spot Welds in Aluminum Alloys. R. C. McMaster and H. J. Grover. *The Welding Journal*, Vol. 26, No. 3, March, 1947, pp. 223–232, illus. 6 references.

Particulars are given about tentative conclusions based on the results of preliminary radiographic tests of a number of spot-weld specimens, and on observations of extensive fatigue investigations in which weld properties were not closely controlled or evaluated. Radiography is said to provide a sensitive method of evaluating weld properties that influence spot-weld fatigue strength.

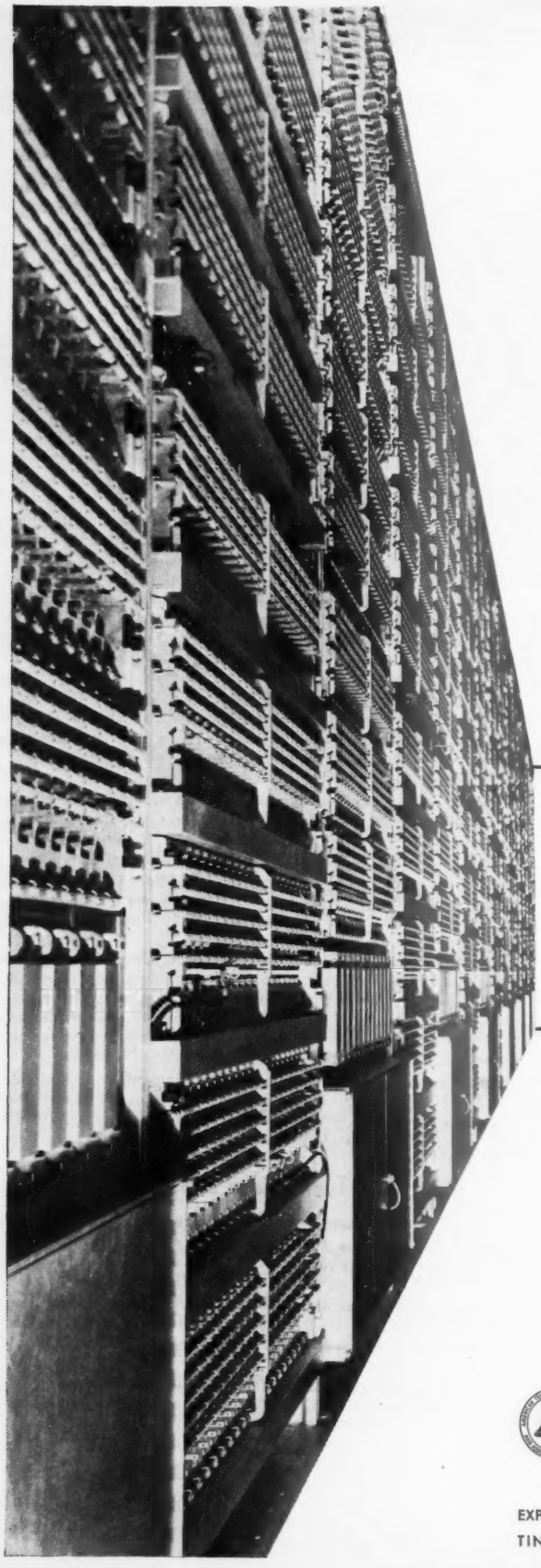
Dornier Structural-Strength Test-Equipment and Methods. A. W. Hotson. (*Gt. Brit., British Intelligence Objectives Sub-Committee, Final Report No. 66.*) *Aircraft Engineering*, Vol. 19, No. 216, February, 1947, pp. 48–51, illus.

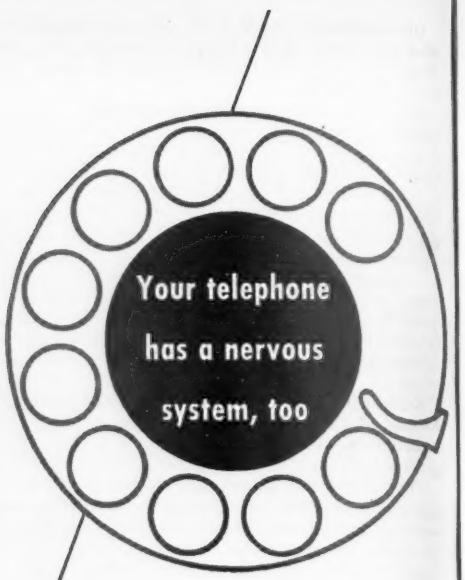
Wind Tunnels and Laboratories

The Use of Damping Screens for the Reduction of Wind-Tunnel Turbulence. Hugh L. Dryden and G. B. Schubauer. *Journal of the Aeronautical Sciences*, Vol. 14, No. 4, April, 1947, pp. 221–228, figs. 7 references. (Cf. AER 2/47:24.)

Pressure-Drop Characteristics of Orifice Plates Used to Simulate Radiators. K. R. Czarnecki. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-342)*, March, 1942. 11 pp., figs. 2 references.

Cornell Aeronautical Laboratory. *Aero Digest*, Vol. 54, No. 3, March, 1947, pp. 59–61, 134, 135, illus.





WHEN you spin the dial of the latest type of telephone system—known as "common control switching"—you order into action a giant nervous system. It sends electrical impulses through an intricate maze of circuits: more than 10,000 contacts can be opened or closed in a single dial call.

This system takes your order, remembers it, translates it into its own electrical language, throws out sensitive "feelers" to find a through route, plans how to make the connections, makes them, puts through the call—and, if the preferred paths are busy, finds an alternate route to take the call.

The complex art of telephone switching is brought to a high state of development at Bell Laboratories to serve the Bell System. Some day through "common control switching" a dial in San Francisco may set up a connection through to a subscriber in New York.

■

Left: Backstage on your dial telephone call — some equipment in a typical "common control switching" office.

Bell Telephone Laboratories

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED ECONOMIES AND IMPROVEMENTS IN TELEPHONE SERVICE

Books

All of the books reviewed and listed are in the I.A.S. Library and may be borrowed without charge, except for certain reference books. Application for loans should be made to The Paul Kollsman Lending Library, 2 East 64th Street, New York 21, N.Y.

Introduction to Aerodynamics of a Compressible Fluid. Hans Wolfgang Liepmann and Allen E. Puckett. New York, John Wiley & Sons, Inc., 1947. 262 pp., figs. $4.00.

This book is an excellent introduction for understanding some important compressible flow phenomena since it emphasizes the derivation of fundamental relations based on physical laws and principles as well as the physical interpretation of these relations. It thereby provides a useful background for formulating significant experiments and theory to further the understanding of such phenomena and for realizing that both methods of research are inherently related and stem from the same fundamental physical considerations.

The book is divided into two parts. The first part reviews basic thermodynamics required in the subsequent theoretic developments, and treats in detail one-dimensional compressible flow in which all the flow parameters are functions of one space variable. In this treatment many of the fundamental features of two- and three-dimensional flow are manifested and clearly interpreted. The equations of motion for a one-dimensional continuous flow are derived and are used for a detailed study of isentropic flows, which, in general, include small stationary and nonstationary disturbances. A systematic development of the theory of flows with normal shock waves is given and accompanied by a brief discussion relating to nonstationary progressive waves. Mach waves are then introduced as an example of extremely weak oblique shock waves. This serves as a good introduction to the theory of oblique shock waves. This is followed by a theoretic treatment of combination shock waves, Mach reflection, condensation shocks and three-dimensional shock waves, which are then applied to channel flows. Methods and techniques for measuring speeds and pressure in one-dimensional flow are presented, followed by a summary of theory relating to supersonic wind-tunnel design. A complete chapter is devoted to the theory and technique pertaining to the shadowgraph, schlieren and interferometer for observing flow.

The second part of the book is concerned with two- and three-dimensional motion. The equations of motion are derived in concise form in terms of tensor rotation. The derivation is systematic and clear. Following is a development of fundamental kinematic relations as manifested by vorticity, circulation, the stream function, and the velocity potential. Approximate methods for solving the equation of motion are then presented. These consist primarily of methods of small perturbation and methods for linearizing the equations of motion.

Sub- and supersonic flows past thin airfoils are investigated. A chapter is devoted to methods of solving the equations of motion which are nonlinear in physical space. These methods consist primarily of the hodograph method and the method of characteristics. Approximate methods for solving the linearized equation of motion in the hodograph plane, such as the methods of Chaplygin and Kármán-Tsien, are clearly summarized. Exact solutions for some steady irrotational isentropic flows are given. Special attention is devoted to considering the questions pertaining to the "lost" solution and to Prandtl-Meyer flows. The method of characteristics and its application to the calculation of supersonic flows past boundaries of arbitrary shape is carefully presented. The remarks in the book concerning the effects of viscosity on mixed compressible flows are interesting. The book is written with exceptional clarity and physical insight and offers the reader an excellent foundation in this timely subject.

PAUL LIEBER

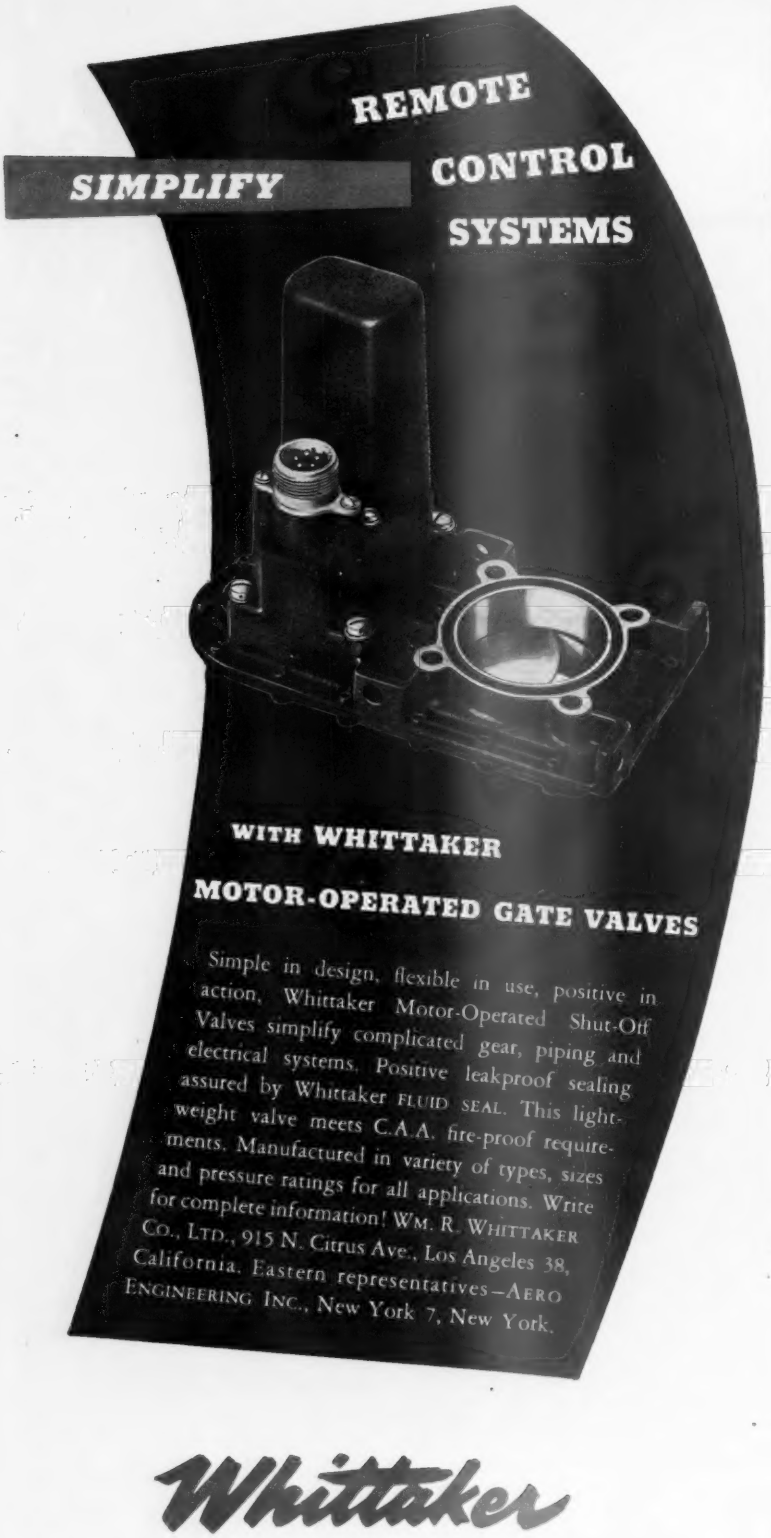
Aircraft Engines of the World, 1947. Paul H. Wilkinson. New York 17, 216 East 45th St., Paul H. Wilkinson, 1947. 352 pp., illus. $10.

This fifth revision of the most complete reference book on aircraft engines available contains nearly 50 per cent new material in the reciprocating engine section, and about 60 per cent new material in the section on jet propulsion engines and gas turbines. The outstanding feature of the book has always been the full information given in uniform data pages, in both English and metric systems of measurement. The introduction to the reciprocating engine section provides a brief summary of developments during the last year, including developments in reciprocating engine equipment. This is followed by 124 data pages on reciprocating engines in eleven countries: the United States, Great Britain, Australia, Brazil, Czechoslovakia, France, Italy, Spain, Sweden, Switzerland, and Russia. The new material includes eight Czechoslovakian reciprocating engines ranging from 65 to 180 hp. at take-off, two Fiat and one Alfa Romeo from Italy, and seven Russian engines mostly ranging from 140 to 1,850 hp. These Russian engines, illustrated by remarkably clear photographs, were developed from French, American, or German models in all cases. The Lycoming XR-7755, at 5,000 hp., is the most powerful reciprocating engine in the world.

The introduction to the jet propulsion and gas-turbine section summarizes recent developments in this field. Great Britain leads in the turbojet and turboprop field, with the United States a close second. The United States leads in the rocketjet field. The 26 data pages of this section, of which 15 are new, include Aerojet Engineering Corporation and Reaction Motors, Inc., models, the BMW 718, the V-2 (A-4), and the Walter HWK 509-C. Less information is available on pulse-jets and ram-jets. A comparative table is given of the jet engines and there is a table also of the more powerful reciprocating engines. A formula is given of equivalent horsepower for the comparison of turboprops and reciprocating types of power plants. Photographs accompany the data pages as in previous editions, and the book is, as usual, well indexed.

Methods of Mathematical Physics. Harold Jeffries and Bertha Swirles Jeffries. Cambridge, The University Press; New York, The Macmillan Co., 1946. 679 pp. $15.

The authors point out that a selection must necessarily be made of methods in pure mathematics which are most frequently needed in physics, since a book containing all methods


SIMPLIFY
REMOTE CONTROL SYSTEMS
WITH WHITTAKER
MOTOR-OPERATED GATE VALVES
Simple in design, flexible in use, positive in action, Whittaker Motor-Operated Shut-Off Valves simplify complicated gear, piping and electrical systems. Positive leakproof sealing assured by Whittaker FLUID SEAL. This light-weight valve meets C.A.A. fire-proof requirements. Manufactured in variety of types, sizes and pressure ratings for all applications. Write for complete information! WM. R. WHITTAKER CO., LTD., 915 N. Citrus Ave., Los Angeles 38, California. Eastern representatives—AERO ENGINEERING INC., New York 7, New York.
Whittaker
DESIGNERS • MANUFACTURERS • DISTRIBUTORS
LEVER AND MOTOR-OPERATED SLIDING GATE SHUT-OFF VALVES • DRAIN COCKS • PLUG VALVES • 3-WAY PLUG VALVES • 4-WAY SELECTOR PLUG VALVES • SWING CHECK VALVES • HYDRAULIC CHECK VALVES

used in different branches of physics would be impossibly long. Most of the methods presented have applications in at least two branches of physics. Harold Jeffries' *Operational Methods in Mathematical Physics*, now out of print, has largely been incorporated into this new book and new material added. Knowledge of the calculus is assumed. Proofs are given under rigorous conditions since the authors state that careful analysis is of primary importance to science, where the principles taken as fundamental must be as closely related to observation as possible.

Among the subjects discussed are the real variable, scalars and vectors, tensors, matrices, multiple integrals, potential theory, operational methods and their physical applications, numerical methods, calculus of variations, functions of a complex variable, contour integration and Bromwich's integral, conformal representation, Fourier's theorem, the factorial and related functions, solution of linear differential equations of the second order, asymptotic functions, equations of potential waves and heat conduction, waves in one dimension and waves with spherical symmetry, conduction of heat in one and three dimensions, Bessel functions and their applications, the confluent hypergeometric function, Legendre functions, and elliptic functions.

Servomechanism Fundamentals. Henri Laver, Robert Lesnik, and Leslie E. Matson. New York, McGraw-Hill Book Co., Inc., 1947. 277 pp., diagrs. $3.50.

The authors are associated with the Radio Corporation of America and their teaching and writing during the war is stated to be the basis for this book, which is intended to provide the engineer with a systematic design procedure for fulfilling specified operating requirements. A clear and readily understandable introduction to basic principles and simple applications is followed by chapters giving a more detailed explanation of follow-up links and then by a review of the fundamentals of mechanics and electricity. This review requires a knowledge of higher mathematics, as does the entire book which is on an engineering level.

Three chapters cover viscous output damping, error-rate damping, and a combination of the two types of damping. Some of the divisions common to all three chapters are: equation of the system, step input system, steady-rate error, solution of the equation, undamped system, underdamped system, dimensionless form of equations, and response to sinusoidal input function. The next three chapters include the means employed for obtaining error-rate damping by error-rate stabilization networks, an analysis of methods of integral control intended to be of value in cases of heavy external load demands such as are encountered in industrial applications, and

an introductory discussion of the transfer function analysis of servomechanisms leading up to stability criterion. The final chapter presents typical design calculations using relations established in previous chapters. A valuable feature of the book is the use of numerous simple diagrams illustrating basic principles in addition to many others for the more technical points.

Airport Operation and Management. Charles A. Zweng. No. Hollywood, Pan'American Navigation Service, 1947. 312 pp., illus. $4.50.

Written for the use of universities, colleges, aeronautical schools, airport operators, and instructors, this book contains information intended to make the student well informed generally. An introductory chapter contains some general considerations concerning relationship with the community, finance, planning conferences, and entrance into the field. Planning and building the airport are then discussed, with important points to be observed in selecting the site and planning for buildings, lighting, drainage, and paving. A list of 15 terms for a master plan covering all phases of development is included.

Chapter 3 is entitled Airport Operation, and covers such topics as responsibilities, maintenance, flight instruction, concessions, traffic control, accidents, and the seaplane base. The subject of airport management is then divided into the subjects of the manager himself, his duties and work, budgeting, accounting, insurance, and other legal points. The important subject of making the airport pay is explained in reference to sources of revenue, charges, sales, rentals, fees, and concessions, and the final chapter deals with the legal aspect of the subject as covered by the Civil Aeronautics Act. Various appendixes are included, covering traffic control, size standards, C.A.A. offices, court decisions, and specimen examinations.

A useful feature of the book is the large number of outlines, check lists, and summaries that are included; for example, an analysis of operating charges by city, the sources of revenue for a typical airport, parts of a sample lease, schedules for an accounting balance sheet, costs of a seaplane base, and an airport safety check list. A handicap to finding desired information is the lack of an index.

Freiheit der Luft Als Rechtsproblem; Rückblick, Gegenwart, Ausblick. Ein Leitfaden für Internationales Luftverkehrsrecht. (**Freedom of the Air as a Legal Problem; Past, Present, and Future.** A Manual for International Air Law.) Alex Meyer. Zurich, Aeroverlag, 1944. 342 pp.

A detailed and well-documented study of the subject divided into the main divisions: general, which includes studies of official international activity and some basic conferences; freedom of the air as a legal problem, in which principles are discussed; freedom of air traffic as a legal problem, where actual flying is involved; limitation of air traffic, with documents and discussion of some specific limitations; and the organization of international air traffic. The half-page of footnote material is frequent, and the texts of the air navigation conventions at Paris, 1919, and the Pan-American convention of 1928 are reprinted at the end of the book, together with a list of treaties up to World War II and reprints of four treaties. The bibliography of seven pages covers works in many languages and the 18-page index is extremely useful.

The Aviation Annual of 1947, Edited by Reginald M. Cleveland. New York, Harper & Bros., 1947. 250 pp., illus. $5.00.

This fourth volume of an annual series deals with 1946, the first full peacetime year since its inception. Authorities in government and private agencies summarize what has been done and give clues to the future. The airport expansion program sponsored by the Civil Aeronautics Administration, and its plans for safeguarding and extending the airways, are outlined by that organization, with forewords by William A. M. Burden and Theodore P. Wright. The Air Transport Association of America reviews the status of the domestic and overseas air lines. Joseph T. Geuting, Manager of the Personal Aircraft Council of the Aircraft Industries Association of America, contributed a chapter on personal flying. The progress of international aviation and the Provisional International Civil Aviation Organization is reviewed by its president, Edward P. Warner.

"Today's Research for Tomorrow's Aircraft" is described by Thomas Leland K. Smull of the National Advisory Committee for Aeronautics, with a foreword by Dr. George W. Lewis. In a symposium on problems of jet and gas-turbine applications, the researches and some conclusions by leading gas-turbine manufacturers and a propeller manufacturer are described. "The Army Air Forces," by William Roberts, of A.A.F. Headquarters, has forewords by Gen. Carl A. Spaatz and Lt. Gen. Harold L. George. A review of the "Highlights of Naval Aviation" by the Bureau of Aeronautics has a foreword by Rear Adm. Harold B. Sallada. The war production victory and the postwar manufacturing picture are described by the Aircraft Industries Association of America, with a foreword by Eugene E. Wilson. Trends in airage education and the contributions of various organizations toward its development are described by N. L. Engelhardt, Jr., with a foreword by S. Paul Johnston. A good index is included.

Die Entwicklung des Raketenantriebes in Allgemein Verständlicher Darstellung (Development of Rocket Propulsion Simply Explained). Joseph Stemmer. Vol. 1, Raketenfahrt—Raketenflug (Rocket Travel—Rocket Flight). Vol. 2, Die Raketenwaffen des Zweiten Weltkrieges (Rocket Weapons of World War II). Vol. 3, Raketenflugprojekte (Rocket Flight Projects). Zurich, E. A. Hofmann, 1944. Vol. 1, 79 pp.; Vol. 2, 72 pp.; Vol. 3, 216 pp.; illus. 8 Sw. fr, Set. Paper.

These three pocket-sized volumes are an interesting addition to the literature on reaction propulsion. The first volume covers general principles, such as the relationship of reaction propulsion, in terms of use and characteristics, to the propeller and the reciprocating engine, the laws of rocket propulsion, and the history of development from the powder rocket to the reaction motor. Some specific experiments discussed are those of Opel with land vehicles and planes, and those of Tilling and Valier. The latter is mentioned in connection with liquid fuels—the subject of the last two chapters. Volume 2 deals with further applications of reaction propulsion in the Campini airplane, various rocket weapons, flying bombs, and the future of rocket flight. Each of eight chapters in Volume 3 is devoted to a specific country and its rocket flight projects. Switzerland, Hungary, Sweden, Italy, and Russia are included.

The most noticeable feature of the books is the large number of illustrations. There are pictures of many persons, both portraits and scenes connected with their experiments, and many illustrations connected with imaginary space travel. A bibliography lists 50 items. The book is intended for popular reading and presents technical aspects of the subject in simplified form with diagrams. Its chief value consists in the assembling of information on various minor experiments, especially in countries other than those usually associated with the subject.

ELECTROL
HYDRAULIC
LANDING GEARS

The Standard Line for Modern Personal Aircraft

Tricycle Conventional Fixed Retractable	HELICOPTERS LAND PLANES AMPHIBIANS

Distinguished by:

1. Light Weight **2. Simplified Design** **3. Standardized Parts**
4. Easy and Economical Maintenance **5. Rugged Construction** **6. Long life**

ELECTROL **has a landing gear for every type of Personal Aircraft**

ELECTROL INCORPORATED

FOR BETTER HYDRAULIC DEVICES

KINGSTON, NEW YORK

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES • CHECK VALVES • RELIEF VALVES
HAND PUMPS • POWERPAKS • LANDING GEAR OLEOS • SOLENOID VALVES • ON-OFF VALVES
SERVO CYLINDERS • TRANSFER VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

Personnel Opportunities

This section is for the use of individual members of the Institute seeking new connections and organizations offering employment to aeronautical specialists. Any member or organization may have requirements listed without charge by writing to the Secretary of the Institute.

WANTED

Aerodynamicist—Person familiar with calibration of and testing procedures in high-speed wind tunnels to direct these activities on a new tunnel. Reply should contain information concerning education, experience, and when available and should be addressed to the Employment Office at Cornell Aeronautical Laboratory, 4455 Genesee Street, Box 235, Buffalo 21, N.Y.

Controls Engineer—Experienced, for development of controls and valves associated with large rocket propulsion systems in guided missiles program. Desired background: electrical or mechanical engineering degree and minimum of 5 years' experience in the practical development of valves, servomechanisms, and automatic controls. Address reply to Engineering Personnel Office, North American Aviation, Inc., Municipal Airport, Los Angeles 45, Calif.

Research Engineers and Physicists—Engineers, physicists, chemists, and mathematicians with research experience in problems related to aeronautics are needed by the National Advisory Committee for Aeronautics. Salaries for various positions requiring research experience range from $3,397 to $9,975 per year, depending on the type and level of work. Entrance positions for college graduates pay $2,644 per year. Areas of research include the following: aerodynamics, hydrodynamics, structures, materials, thermodynamics, compression and turbines, fuels and combustion, lubrication, mathematics, optics, electronics, radar, telemetering, servomechanisms, and other fields. Applications for positions or requests for further information should be addressed to the personnel officer at one of the following laboratories: Langley Memorial Aeronautical Laboratory, Hampton, Va.; Ames Aeronautical Laboratory, Moffett Field, Calif.; Aircraft Engine Research Laboratory, Cleveland.

Aircraft Equipment and Accessory Engineer—Excellent opportunity for graduate A.E., M.E. or E.E. with at least 4 year's practical experience as application engineer on electromechanical actuators, electric motors, and automatic control for aircraft. Reply to Lear, Incorporated, 110 Ionia Ave., N.W., Grand Rapids 2, Mich.

Electronic Engineer-Pilot—A position is open for a highly qualified electronic engineer who is also an expert multiengined pilot. The work will consist primarily of flight research and test of aeronautical automatic controls of many descriptions. The engineer will be involved from the inception of an idea or device, through its development stages, in the planning and flying of the tests, to the final demonstration and sales stages. It is desirable that the applicant be skilled in instrument and airways procedures or is a former air-line, N.A.T.S., or A.T.C. pilot. Apply by letter, giving engineering and flight experience and starting salary expected, to Chief Flight Test Engineer, Minneapolis-Honeywell Regulator Company, 2753 Fourth Ave. S., Minneapolis.

Engineers—Young engineering graduates with up to 3 years' experience required for test activity and aerodynamic or thermodynamic analysis on extensive and continuing development programs on nonrotating aircraft power plants. Mechanical or aeronautical engineers preferred. Address reply to Continental Aviation and Engineering Corporation, Detroit 14.

Aerodynamicists—College graduates with sound theoretical training and at least 1 year of graduate study in compressible subsonic flow and supersonic flow to do research and test work in the Supersonic Wind Tunnel of the Ballistic Research Laboratories, Aberdeen Proving Ground, Md. This is one of the few operating supersonic wind tunnels in the country having a test section larger than 1 sq.ft. Remuneration in accordance with qualifications. Write, giving education and experience, to The Commanding General, Aberdeen Proving Ground, Md., Attention: Director, Ballistic Research Laboratories.

Structural Designers—Experienced in sheet-metal aircraft structures for new helicopter design. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Layout Draftsmen—Five or more years' experience on aircraft layout and design. Rotary wing preferred. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Aerodynamicist and Vibration Specialist—Experienced in rotary wing field. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Assistant Designer—Wanted immediately by Canadian branch of leading aircraft hydraulics and landing-gear specialists. Must be capable of taking full responsibility for undercarriage design projects, and should have had some experience in design of hydraulic pumps, systems, and electro-hydraulic units. Knowledge of stress analysis and familiarity with both British and American engineering practices also desirable. This is a permanent position with good prospects. Starting salary $275 to $300 per month, depending on qualifications. Apply in writing to Chief Engineer, Dowty Equipment (Canada) Limited, 999 Aqueduct St., Montreal 3, Canada.

Senior Draftsman—Wanted immediately by Canadian branch of leading aircraft hydraulics and landing-gear specialists. Must have minimum of 3 years' experience in the more mechanical side of aircraft design work and, preferably, 1 year's design experience on undercarriage and hydraulics, variable-pitch propellers, fuel systems, or other similar accessories. Should be capable of detailing any undercarriage or hydraulic layout and of carrying out elementary stress analysis. Familiarity with both British and American engineering practices also desirable. This is a permanent position with attractive prospects. Starting salary proportional to qualifications offered. Apply in writing to Chief Engineer, Dowty Equipment (Canada) Limited, 999 Aqueduct St., Montreal 3, Canada.

Assistant or Associate Professor—To teach courses in aerodynamics and wind-tunnel and airplane design. Must have graduate work in aerodynamics. Prefer man with teaching and practical experience. Salary and position will depend upon qualifications. Applicants should submit detailed record of education and experience. Address reply to Aeronautical Engineering Department, University of Kansas, Lawrence, Kan.

Aerodynamicists and Aeronautical Engineers—Positions available for highly qualified technical personnel with good theoretical or experimental background to engage in development and test work in stability, control, high-speed, and supersonic aerodynamics. Projects include new designs of piloted and pilotless aircraft, new wind tunnels and associated equipment, and advanced testing techniques. Salary in accordance with qualifications and Civil Service regulations. In reply please give brief summary of personal qualifications, education and experience. Address: Director, David Taylor Model Basin, Washington 7, D.C.

718. Aerodynamicists—Services of several highly qualified aerodynamicists are required by a Midwest firm investigating supersonic wind tunnels for Government facilities. Preference given to those with experience in design of compressors, nozzles, refrigeration and drying equipment, and wind-tunnel instrumentation. A good background in supersonics, mathematics, and physics is preferred but will consider others with subsonic experience in above fields. Applicants should write giving complete details of education, experience, and salary expected.

706. Assistant Professor—To teach courses in aircraft structures and aircraft structures laboratory at an Eastern university. The primary duties of the position will be concerned with aircraft structures, but the applicant should possess enough knowledge of aerodynamics to permit him to assist occasionally in elementary aerodynamic courses. Prefer a man with teaching and practical experience. In applying, please give brief sketch of personal qualifications, education, and experience.

679. Professor of Aeronautical Engineering—To take charge of work in established department of aeronautical engineering at a large engineering college. A man with graduate degree, teaching and industrial experience preferred. Rank and salary dependent upon educational background and experience.

671. Instructor or Assistant Professor—Sought by Aeronautical Engineering Department of Southwestern university. Should have master's degree and be able to teach in fields of aerodynamics and fluid mechanics, structures, and power plants and be capable of specializing in one of these.

670. Research and Aerodynamics Engineers—Long-term helicopter development program for Army Air Forces requires additional experienced and capable engineers. Exceptional working conditions and opportunities. Work involves aerodynamics, vibration, and flutter analyses on advanced designs. Substantial experience in

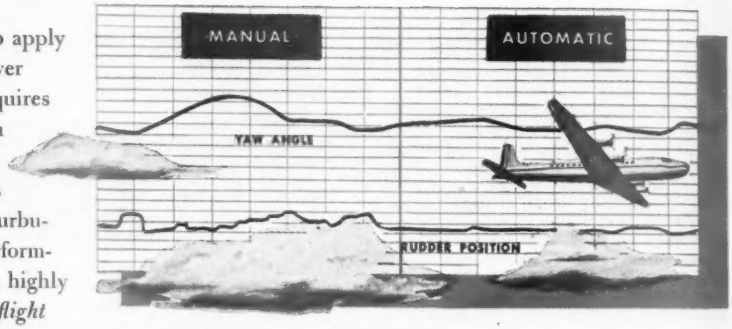
The number preceding the notices represents the Box Number of the Institute of the Aeronautical Sciences to which inquiries should be addressed.

The Sperry A-12 Gyropilot . . .

helps the human pilot to do his job better and with less effort than by manual manipulation of his controls . . . gives him complete gyro-stabilized control of his aircraft under all flight conditions.

For Smoothest Flight at all Times

the A-12 Gyropilot has the ability to apply gentle but alert control corrections whenever needed. This improved *automatic* control requires half or less the control movement a human pilot applies trying his best to hold the plane in smooth flight. Actual continuous recordings (right) of flight through turbulent air show a marked difference in performance between *manual flight* with a highly competent human pilot and *automatic flight* with the highly competent A-12.



Can Bring New Flying Comfort to Your Passengers

with tight, deadbeat control of aircraft eliminating over-control, "hunting" and "wallowing" . . . providing smoother, more comfortable, more enjoyable flying.

• • •

AND IN THE MARINE FIELD, *Sperry Gyro-Pilots, linked with Sperry Gyro-Compasses, are providing automatic straight-line steering.*

Sperry Gyroscope Company, Inc.

EXECUTIVE OFFICES: GREAT NECK, NEW YORK • DIVISION OF THE SPERRY CORPORATION

New York • Los Angeles • San Francisco • Seattle • New Orleans • Cleveland • Honolulu

aerodynamics or vibration work essential. East Coast company.

651. **Aeronautical Administrative Engineer**—Experienced in handling Navy Contract procedures and in designing for production. All replies will be held confidential. East Coast company.

AVAILABLE

721. **Engineering Writer**—B.S. degree in Aeronautical Engineering, Purdue. M.S. in Journalism. Married; 23 years old. Has taught aircraft structures and mathematics. Wants to work with a technical publication as assistant editor or similar post. Although magazine work is preferred, will consider any position that would draw upon engineering and writing training.

720. **Development or Design Engineer**—Twelve years' specialized in power plant installation, design, test, research and proposal work as designer, group engineer and senior project engineer. Also familiar with design, test, and performance calculations of exhaust ejector pumps and thrust augmenters, and some design of ramjet engines. Five years' air-frame design experience and 5 years' diversified shop, tool engineering, and plant engineering work. Since end of war, partner in a small Midwestern engineering company doing some work on airplane component design. Well versed in organizing and follow through of projects and in dealing with personnel. Born, graduated, and 5 years' engine-design experience in Germany. In United States since 1929; citizen since 1935; age 45; married. Desires position with airplane or component manufacturer or operator as a design development, test, field, or maintenance engineer. Starting salary and location secondary if opportunities are right. Available immediately.

719. **Aeronautical Engineer**—B.S. degree in Aeronautical Engineering; graduate work, majoring in physics; age 31. Eight years' aeronautical engineering experience, consisting of 6 years in stress analysis, structural testing, and structural design criteria development and 2 years in preliminary aircraft design. Thoroughly experienced in aerodynamics, aircraft structures, and design. Capable as a project engineer and in the supervision of engineering and laboratory personnel. Desires position requiring initiative and responsibility in which engineering experience and background will be of value.

717. **Aeronautical Engineer**—M.S. in Ae.E.; A.B. in mathematics. Four years' experience in stress analysis, flutter, and vibration with leading aircraft firms. Interested both in teaching and in industry, preferably in New York area.

716. **Pilot**—Position wanted as pilot for private concern with sales engineering possibilities. B.S. in Ae.E. Four years' engineering experience with airplane manufacturers. Four and one-half years' air-line experience in twin-engined and four-engined equipment; 2,600 hours' logged time. C.A.A. ratings held—commercial, single- and multiengined land, instrument, and instructor. Free to locate anywhere but Chicago preferred.

715. **Instrument Engineer**—B.E.E., Cornell University, 1943. Four years' experience with recording and indicating instrumentation in flight test division of leading aeronautical research laboratory. Developed instrumentation and calibration techniques and supervised the installation and maintenance shop personnel. Desires position with aeronautical laboratory or instrument manufacturer.

714. **Aeronautical Engineer**—B.S., Rensselaer Polytechnic Institute. Age 24. Well experienced in the structural analysis and design development of supersonic military aircraft and missiles. Additional experience and background include aerodynamics major as undergraduate and 3 years in U.S. Navy as aircraft engineering officer-specialist in structures and engine maintenance and repair. Desires permanent position with West Coast aircraft concern. Prefers to continue work in supersonic research and development in either structures or aerodynamics.

713. **Manufacturers Representative, Sales, or Field Engineer**—Engineer with 17 years' aeronautical design, plus 3 years of successful aircraft sales engineering experience. Has technical, executive, and sales ability. Desires connection with distributors or manufacturers to handle products selling to West Coast aircraft industry. Well known to both engineering and purchasing personnel of California aircraft companies. Available immediately.

712. **Materials, Processes, and Standards Engineer**—M.E. degree; seeks position with aircraft or metal fabricating plant in New York Metropolitan area or Long Island. Excellent record: nationally known author; prominent welding consultant; authority on materials, processes, and standards; research; design; administration; production; industrial engineering; estimating. Presently employed with one of America's foremost aircraft companies.

711. **Professor of Aeronautical Engineering**—B.S. in M.E.; M.S. in A.E. Five years' teaching experience as Associate Professor of Aeronautical Engineering, in well-established engineering college. Five years' varied industrial experience, including development work on guided missiles. Desires permanent position in recognized engineering college teaching airplane design and aerodynamics. Primarily interested in research and development of light planes. Available immediately.

710. **Aeronautical Engineer**—Married; age 30. Four years' experience in structures and static test. Experience in electronic instrumentation for testing. Six months at Wright Field as company representative for static test of large airplane. Two years' experience in structural and mechanical design for high-speed variable density wind tunnel. One year in Navy radar program. Now attending California Institute of Technology. Will obtain M.S. in Aeronautics in June. Would like industrial research or teaching and research with work toward a higher degree. Available in June.

709. **Aeronautical Engineer**—B.S. in Ae.E. Experience includes structural testing, drafting, and liaison on both military and commercial aircraft. Seeks position in structural testing or wind-tunnel testing. Location open.

708. **Aeronautical Engineer**—Financially independent, as the result of successful designs, desires new position on West Coast with sufficient authority or scope to be able to obtain results. Successful projects previously headed, both commercial and military, will be furnished as proof of ability to lead either design or research developments. Salary is of minor importance.

707. **Sales Engineer**—Engineer with 27 years' experience in aircraft engineering and manufacturing. Has ingenuity and engineering ability combined with sales ability. Desires sales engineering connection in Los Angeles area in any field requiring these characteristics.

705. **Aeronautical Engineer**—Former pilot; long and broad experience in nearly all phases of airplane design, manufacture, and operation. Lately specializing in gas turbines and hydraulics. Especially interested in development.

704. **Aeronautical Engineer**—Seventeen years' experience on airplanes and 2 years on helicopters as layout man, group leader on drafting, design draftsman, chief draftsman, project engineer, design engineer, and assistant chief engineer, concerning commercial and military aircraft. College education and 5 years' original experience in mechanical engineering.

703. **Aeronautical and Aircraft Maintenance Engineer**—B.Ae.E., N.Y.U., 1944. Two and one-half years' overhaul, maintenance, modification, and repair of single- and multiengined aircraft in both military and commercial aviation, plus previous limited association with manufacturing industry. Seeks a responsible engineering position to which adaptable in either manufacturing industry or air transport. Will consider overseas employment.

702. **Engine Research Technician and Draftsman**—College background; 2 years' aeronautical engineering; 29 years old; married. Nine years of technical and practical experience in aircraft-engine production and development. Thorough familiarization with engine design and development, laboratory testing and research, engineering analysis, and layout and detail drafting. Two and one-half years' experience with gas-turbine and jet propulsion engineering projects at U.S. Navy Air Test Research Center. Desires permanent position with leading engine manufacturer or experimental development unit in research, development, designing, or liaison capacity, preferably in New England or Eastern Coastal area.

701. **Mechanical Engineer**—Age 30; B.S. and M.S. degrees. Two and one-half years' aircraft-power-plant installation design and development. Three and one-half years' aircraft gas-turbine thermodynamic analysis involving design of turbine and compressor elements and performance evaluation. Both jet and prop-jet experience. Desires responsible position on gas-turbine or allied power-plant work having good growth possibilities. East Coast area preferred.

700. **Project Engineer**—Age 36. B.S. in M.E., plus some postgraduate work. Nine years' experience in production and development of electromechanical instruments. This work has included considerable time spent with laboratory, manufacturing, and inspection groups and also with customers on related engineering problems. Especially interested in cost-reduction work. A complete outline of experience and qualifications will be sent upon request.

699. **Chief Inspector or Experimental Department Head**—Twenty years' experience in the aircraft industry, including experimental, quality control, and production analysis. Seeks position as chief inspector or head of experimental department. Location open.

698. **Engineer and Executive**—Almost 30 years' experience on airplane and accessory design, airport selection and layout, and airplane operations engineering. Good organizer and manager; sound business experience; capable technical writer; wide knowledge of materials and processes.

697. **Aircraft Structural Engineer**—Graduate engineer, B.S. in M.E., Ae.E. Two years' aircraft structural design and research experience. Design experience gathered with both military and personal aircraft. Thoroughly familiar with C.A.A. requirements and static testing. Structural research experience gathered while in the Army Air Forces. Desires position in structural design or structural research department. Will locate anywhere.

696. **Aeronautical Engineer**—B.S. in Ae.E., New York University (Guggenheim School of Aeronautics). Almost 2 years' mechanical training and experience in the A.A.F. Six months' experience with small West Coast aircraft company performing design and stress analysis of major components of prototype airplane under supervision of chief engineer. At present, graduate student at M.I.T., specializing in rotary wing aircraft working toward S.M. in Ae.E. Good grades throughout schooling. Desires position with progressive helicopter company. Available about July 1. Details and references upon request.

695. **Administrative Engineer**—Age 40; 6 years in aircraft engineering department, from design engineer to managing the department of approximately 2,000 people. Past year personnel

G&O
Radiators
32nd Year

ENGINE COOLING
RADIATORS

•

OIL COOLERS

The G.O Manufacturing Co.

NEW HAVEN, CONNECTICUT

Right on the nose of
the Aeronca Champion

She's every inch a champion. On her nose there's a Sensenich propeller that helps to keep her one. For the best combination of take-off, climb, cruise and for happy landings, Aeronca knows that Sensenich props are tops. Aeronca is one of a long parade of prominent personal plane manufacturers that standardize on Sensenich propellers.

Prompt repair service on wood propellers (all makes) at a Sensenich PROP-SHOP.

Standard of Performance

AIRCRAFT SENSENICH PROPELLERS
Trade Mark

SENSENICH CORPORATION
LANCASTER, PA. GLENDALE, CALIF.

manager of newly organized aircraft maintenance base. Previous experience as an instructor in aeronautical subjects and draftsman. Desires permanent position, preferably in aircraft, involving engineering and personnel administration. Location open.

694. **Management**—Age 43, married, A.B. degree and B.S. in Aeronautical Engineering, plus legal training and experience. Author of seven outstanding textbooks on technical subjects. Biography in *Who's Who in America*. Member I.A.S. and Associate Member American Institute of Electrical Engineers. Last 6 years spent organizing and managing aeronautical training for engineers, pilots, and mechanics in advanced types of aircraft. Desires permanent position as organizer and manager of a well-financed college or school wishing to develop strong courses in aviation business administration, jet and gas turbine propulsion, or electronics. Prefers West Coast.

693. **Development Engineer**—Graduate engineer, with 8 years' experience in hydraulics, landing gear and mechanical design, seeks position with small company where the opportunity exists to expand along with the company.

692. **Mechanical Engineer**—Graduate; age 30; 4½ of 6 years' experience in development of mechanical components of helicopter aircraft. Interested in development work. Location: (1) New York; (2) San Francisco; (3) Seattle.

691. **Aeronautical Engineer**—B.Ae.E., 1942. Age 25, married. Two years' experience in design evaluation of regular and experimental aircraft. Two years' experience in aircraft flight testing and aircraft maintenance. One year's experience in supersonic research leading to the design of guided missiles. At present engaged as a research technician in supersonics. Desires administrative position as a project engineer in the research and development of supersonic aircraft. Familiar with Government contracts and procedures.

690. **Administrator-Industrial Management Engineer**—Representative completing 6 years in Naval Aviation as administrator of fixed price and cost-plus fixed fee airplane contracts from inception to fly-away at several large plants and the Bureau of Aeronautics. Ten years' civilian aircraft experience covering production, engineering, and quality control. Good engineering training secured at recognized technical institute and university.

689. **Engineer**—Five and one-half years' experience as layout draftsman on aircraft construction; location in Eastern States preferred.

688. **Engineer**—B.A.E., N.Y.U., major in air transport and meteorology. Two years' experience leading aircraft instrument and accessory manufacturer as designer, junior administrative engineer. Served in U.S. Navy as officer engineer in design and development of autopilots and radio-controlled aircraft and structural test models; 1 year's experience in this field including considerable flight-test work. Six months' experience with Navy as production control officer in aircraft plant. Desires work in East Coast area in any of the above fields.

687. **Professor or Aeronautical Engineer**—Ph.D. in Mathematics and Physics. Author of a number of published articles in aerodynamics and mathematics. Ten years' teaching experience in graduate and undergraduate engineering mathematics; over 7 years' general aircraft engineering experience, including positions as project aerodynamicist and engineering specialist on Navy and Army aircraft and guided missiles. Available for responsible position immediately either with aeronautical college or with aircraft industry.

686. **Sales Engineer and Aeronautical Marketing Consultant**—Exceptional aeronautical background and history. Entree to every phase of aircraft manufacture and operation. Internationally known and respected. Has excellent contacts, particularly on the Pacific Coast. Has designed and patented several successful accessories. Has been in the aircraft field for over 30 years.

685. **Aeronautical Engineer**—B.Ae.E., Rensselaer Polytechnic Institute with honors, full member Sigma Xi, Tau Beta Pi; now completing master's work at M.I.T. with major in vibrations and stress analysis. Energetic, intelligent, and learns quickly. Has ability to assume and desires responsibility. Desires employment in vibration research or flight-test analysis with concern on East Coast or opportunity to develop courses in vibrations at small engineering college. Plans to extend education in law and engineering administration. Résumé on request.

684. **Teacher**—College teacher desires position teaching aeronautical engineering at recognized college or university. Possesses B.A.E. degree, magna cum laude. Doing graduate work at present on parttime basis. Three years of progressively responsible industrial experience including analysis and design of tubular and stressed-skin structures and of the mechanical elements of civilian and military aircraft, particularly in the rotary wing field. Also some experience in theoretical aerodynamics. Over 1 year's experience as instructor of mechanical engineering at accredited college. Qualified to teach courses in aerodynamics, fluid mechanics, advanced strength of materials, airplane design, structures and stress analysis, and rotary wing aircraft.

683. **Air Cargo Transport Engineer and Administrator**—Available on short notice, internationally known air transportation engineer, specializing in air cargo. Just completed setting up largest all-cargo operation in Western hemisphere, in South America. Capable of making complete survey, procuring equipment and personnel, and setting up operating organization. Would be interested in acting as consultant for major railroad anticipating aircraft activity or any other organization interested in air cargo. Thirty years' experience in the aircraft operating field. Has lived and operated in Europe and South America.

682. **Aeronautical or Administrative Engineer**—Age 33, married. Ten years' aircraft engineering experience, including drafting of specifications, structural design, aerodynamics, and 3 years' service in the Engineering Division at Wright Field as an A.A.F. officer. Familiar with current A.A.F., Bureau of Aeronautics, British, and C.A.A. structural and design requirements. Desires position about June 1.

681. **Physicist-Mathematician**—Age 35. B.S. in E.E., M.A. in Mathematical Physics, B.Sc. (Oxon.) in Astrophysics. Presently Associate Professor Aerological Engineering. Four years' experience scientific book publishing (McGraw-Hill). Five and one-half years' Navy. Desires position Northeastern United States in research and/or teaching with growing responsibilities in administration.

680. **Aeronautical Engineer**—B.S. degree in Aeronautical Engineering, Aeronautical University, Chicago. Five years' experience in design and research with leading aircraft manufacturer, including work in stress analysis, aerodynamics, and jet propulsion. Holds private pilot's license and has had some aircraft mechanic experience. Prefers Southern California.

678. **Aeronautical Engineer**—With administrative experience desires position as personal assistant to executive in air line, aircraft manufacturing or related activity who should be relieved of concern over details—correspondence, reports, speeches, department liaison. Aero engineering degree, Harvard Business School. Six years' over-ocean air-line experience in maintenance and engineering, in which presently employed. Ex-Naval officer, free to travel. Has smattering of Spanish. Age 29. Interview desired.

677. **Aeronautical Engineer**—Technical degree received from well-known and approved cooperative engineering college of a midwestern university. Three and one-quarter years' complete stress analysis experience with leading personal plane manufacturer. Some liaison and service

engineering experience. Desires position with personal plane or helicopter manufacturer or consulting engineer as a structures, service, or liaison engineer. Will consider position as aerodynamicist or sales engineer of a reliable company with a temporary salary sacrifice if well-rounded experience will be gained. Complete information will be given on request.

676. **Aeronautical Engineer**—B.Ae.E. More than 5 years' experience in experimental aerodynamics and flight testing. Present position is that of project engineer on high-speed developments. Desires position in Northern New Jersey or New York City which involves work in aerodynamics, design, flight testing, or wind-tunnel testing.

675. **Technical Translator**—Graduate mechanical and aeronautical engineer, German born, U.S.-educated, thoroughly bilingually familiar with engineering terminology, will translate German technical documents on a contract basis.

674. **Aeronautical Engineer**—Aerodynamicist, B.Ae.E., age 22, single. Has over 2 years' experience in wind tunnel work, air loads, performance, stability, and control. Will receive M.Ae.E. during present school year. Good background in theoretical aerodynamics, stress analysis, and jet propulsion. Interested in teaching. Must remain in New York City vicinity until July 1. Available immediately.

673. **Teacher**—Graduate of the Massachusetts Institute of Technology in aeronautical engineering desires a teaching or administrative position with a foreign or domestic college or university. Qualified to teach aerodynamics, airplane design, wind-tunnel techniques, modern flight-testing methods, air-transport problems, and related fundamental subjects. Holds C.A.A. single- and multiengined commercial pilot's license, with instrument and instructor ratings. Prefers position with opportunity for combining academic work with flight testing, flight demonstration, and/or flight instruction. Has had administrative, practical, and teaching experience in the aviation field. Will gladly furnish complete credentials, with references, upon request.

669. **Aerodynamics Engineer**—Chief aerodynamics engineer with prominent aircraft company. Advanced degree in mathematics and physics. Publications in dynamics and thermodynamics. Experience in aircraft heating and deicing. Desires position in metropolitan area with progressive concern or recognized university.

668. **Administrative or Executive Engineer**—Twenty years' well-rounded experience in all phases of organization, systematizing, design, engineering, production, and helicopter. Has experience in the automotive, aircraft-engine, and aircraft industries. Formerly experimental engineer, assistant engineer, factory manager, and general manager. Will definitely consider position in other than aircraft industry.

667. **Aeronautical Engineer**—B.S. Degree in Mechanical and Aeronautical Engineering. Taking graduate studies majoring in aeronautics. Two years' experience in drafting and aerodynamics in the aircraft industry, doing layout, major detailing, casting and forging drawing. Interested in aerodynamics or stress-analysis positions. Will accept mechanical or aeronautical engineering position in the Far East, especially in the Philippines.

666. **Sales and Service Engineer**—B.AeE., N.Y.U., 1941; married, age 28. Four and one-half years' A.A.F. Engineering Officer (Major). Varied technical and administrative assignments in connection with modification, overhaul, and repair of all types of aircraft and associated equipment. One year own manufacturing business. Few months air line. Completing training for Commercial Pilot Certificate. Particularly interested in sales and service or employment with overhaul and/or modification agency.

665. **Training Supervisor**—Twelve years of practical aeronautical and teaching experience, ranging from instructor to training supervisor at a U.S. Naval aircraft shore establishment. Background includes the training fields of private trade school, public school, air line, and Government plants. Capable of planning, administering, coordinating, teaching, and testing school, shop, and supervisory improvement courses. Experience has covered mechanical training on the job, apprenticeship training, supervisory improvement training and testing, and veterans' training.

664. **Aeronautical Engineer**—B.Ae.E., age 29, married, veteran of World War II. Four years as a Naval Aviator. Two thousand hours' flight experience in single- and multiengined land and sea aircraft. Possesses valid commercial pilot's license. Experience as a project engineer, design draftsman, and stress analyst. Working knowledge of all phases of aviation. Desires position as a flight test engineer. Will consider positions anywhere in the continental limits of the United States.

663. **Engineer**—Heating, ventilating, and exhaust systems engineer; B.S. in Ae.E. Age 29, married. Four and one-half years' experience in the design, maintenance, and overhaul of aircraft exhaust, heating, and ventilating systems. Completely familiar with all types of aircraft and ground heaters, heat exchangers, anti-icing and deicing systems and ventilating systems. Experienced in problems relating to aircraft-engine exhaust systems, such as collector rings, short stacks, flame dampeners, silencers, and carburetor heater shrouds. Has a working knowledge of turbosupercharger and induction systems. Exceptional executive and supervisory experience. Desires position as sales or field service engineer. Other engineering positions will be considered.

662. **Production or Factory Management**—B.S.E. (Aero. Eng.); top quarter, Big Ten University class. Six months' prewar experience in production control with leading parts manufacturer. Three years as A.A.F. engineering officer in charge of aircraft overhaul subdepot, supervising 350 civilian employees, machine shop, sheet metal, welding, woodmill, etc. One year postwar as aircraft structures engineer. Desires responsible position in production or factory management with progressive-minded manufacturer of mechanical products. Keenly interested in production control, production planning, and factory management and will consider opportunities in any related position. Mid-West preferred.

661. **Research Engineer**—Age 29. B.S. in M.E., University of Pennsylvania, 1940. Experienced analyst in thermodynamics, heat transfer, general fluid mechanics, and aerodynamics. Present employer well satisfied, but applicant wants nonmilitary research work. Six and one-half years with large aircraft manufacturer, past year and one-half on supersonic studies, including setting up Schlieren optical system and developing method of analysis for flow of compressible fluids.

660. **Engineer-Pilot**—M.E.; several years' experience many military and commercial types, land, sea, and helicopter; commercial and instrument ratings; 4 years' test and research with reputable organizations. Good knowledge of operational problems; well acquainted with current electronics equipment and its limitations. Desires change. Interested in pilot-engineering-administrative position with concern having well-backed program.

658. **Administrative-Executive-Field Service**—Desires to join group with sound research and modest production program. Twenty-one years' experience in the industry in almost every phase; now staff member in responsible position with large engine firm. Holds commercial pilot's license with instrument and instructor ratings, single- and multiengined, A and E license. Prefers to affiliate with group that can use several thousand hours' flying experience plus sales and executive ability.

656. **Management Executive**—B.S. in M.E. Over 20 years' experience in aviation, including engineering, production, quality control, materials, contracts, labor problems, costs, contract termination, and property disposal. Five years' research, N.A.C.A., hydrodynamics, and aerodynamics. One year on flight performance data analysis. A and E mechanic, private pilot. During war represented the Bureau of Aeronautics in plants of major aircraft manufacturers, heading staffs up to 160 engineering, clerical, and shop personnel. Long experience in dealing with Government agencies. Desires responsible position with an organization needing a versatile, well-informed executive.

655. **Engineer or Executive**—Twenty-four years' experience in tool, production, and design engineering; 8 years in aircraft. Positions filled include project engineer, chief tool designer, chief production engineer, and chief engineer. Thoroughly capable of handling either design, production, or tooling and methods. Willing to accept lesser position if opportunity for advancement is evident.

645. **Associate Professor of Aeronautical Engineering**—Doctor of Aeronautical Engineering in a large Mid-Western university would like to change his position for a similar one. At the present time gives structural courses. Possesses experience in wind-tunnel operation and a thorough knowledge of aerodynamics.

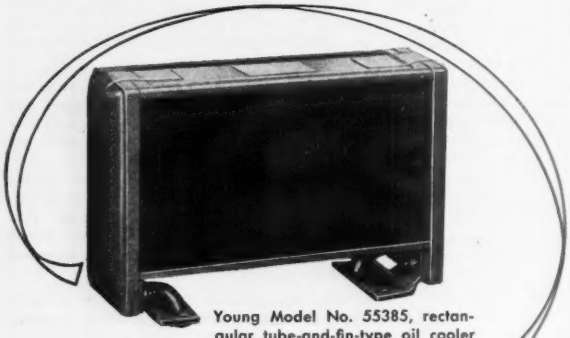
641. **Aeronautical Engineer**—B.Ae.E., Rensselaer Polytechnic Institute, 1939. Age 31, married. Private pilot. Eight years' design and field engineering work including administrative and supervisory experience for major aircraft accessory manufacturer. Ground and flight test experience, both Army and postwar commercial planes. One year project engineer and market analyst for development of light-plane products. Well-established West and East Coast aircraft contacts. Desires administrative or sales engineering position in aircraft or allied industry. Prefers East or West Coast. No objection to traveling. Available immediately.

Plan Now to Attend

Annual Summer Meeting

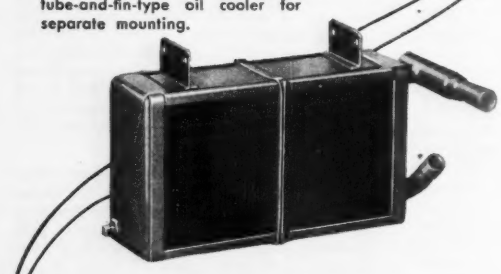
Los Angeles, Calif., August 7-8, 1947

YOUNG PRESENTS NEW LIGHT-WEIGHT OIL COOLER FOR PERSONAL PLANES



Young Model No. 55385, rectangular tube-and-fin-type oil cooler for mounting on engine block.

Model No. 54692, rectangular tube-and-fin-type oil cooler for separate mounting.



With the "future" of personal airplanes so dependent upon safe, economical operation combined with minimum cost, the new Young rectangular tube-and-fin-type oil cooler is hailed by plane manufacturers and owners alike as an important contribution toward meeting such requirements. These new coolers are 50 percent lighter, 75 percent less costly than the conventional round cellular-type aircraft oil cooler. Models available have capacities to properly cool engines from 75 to 220 H.P. size. Construction details include: provision for thaw-out; internal agitation; designed cores for maximum heat transfer at minimum weight.

Here is another example of Young's ability to apply specialized heat transfer engineering to the critical needs of a highly specialized industry. Consult the Young Engineering Staff today.

YOUNG

HEAT TRANSFER PRODUCTS

OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • HEAT EXCHANGERS
INTERCOOLERS • EVAPORATIVE COOLERS ENGINE JACKET WATER COOLERS
GAS COOLERS • UNIT HEATERS CONVECTORS • CONDENSERS • AIR
CONDITIONING UNITS • EVAPORATORS HEATING COILS • COOLING COILS
AND A COMPLETE LINE OF AIRCRAFT HEAT TRANSFER EQUIPMENT

YOUNG RADIATOR CO., Dept. 477E, RACINE, WIS., U.S.A.

Former secret information — now available in

GERMAN RESEARCH IN WORLD WAR II

By COLONEL LESLIE E. SIMON

An absorbing book which discusses in detail German war methods of research in relation to more practical application and manufacture of new devices. Colonel Simon explains—with examples—not only the extent to which the Nazis succeeded or failed but *why* they did. The descriptions of new scientific developments relate to the more important researches in interior ballistics and terminal ballistics, exterior ballistics and fire control, aerodynamics, and instruments and measurement technique.

May 1947 220 pages $4.00

ON APPROVAL COUPON AER-6-47

JOHN WILEY & SONS, INC., 440 Fourth Ave., New York 16, N. Y.

Please send me, on ten days' approval, a copy of Simon's GERMAN RESEARCH IN WORLD WAR II. If I desire to keep the book, I will remit $4.00 plus postage; otherwise I will return the book postpaid.

Name.....

Address.....

City.....

Employed by.....

(Approval offer not valid outside U. S.)

Books that tell you how

FLIGHT TESTING

Conventional & Jet-Propelled Airplanes

by Benson Hamlin

A complete text, handbook, and reference on methods of deriving and analyzing flight-test data for all types of aircraft, jet-propelled as well as propeller-driven. Written by an engineer who has worked in the aerodynamics and flight-test sections of five leading aircraft concerns, the book provides the first complete standardization and systematization of data reduction methods, and of the terms and symbols used. All essential theory is explained, and there are 12 large charts for the simplification of calculations and many useful reference tables. $5.00.

AERODYNAMICS

by L. R. Parkinson

A brief, simply written explanation of all basic principles, with much useful data on airfoils, stability, flight tests, wind tunnels, etc. A handy guide for all those in design, research, engineering and testing departments and for others needing a basic knowledge of aerodynamic principles. Illus. $2.25.

Send for on-approval copies

The Macmillan Co., 60 Fifth Ave., New York 11

(*Continued from page 25*)

Symposium

The evening symposium was devoted to a discussion of the performance of various types of aircraft propulsion systems by members of the staff of the Cleveland Laboratory, N.A.C.A. A series of related papers were presented covering the six systems currently employed. In each paper a brief discussion of the basic characteristics of one of the propulsion systems was presented, followed by a study of the load-carrying capacity and fuel rate per mile made possible at various flight speeds and altitudes. The results of studies on these propulsive systems were summarized on one chart for subsonic speeds and on another chart for supersonic speeds to illustrate the place of each in the aircraft performance spectrum.

E. J. Manganiello, Chief, Thermodynamics Branch, presented a report coauthored with L. V. Humble on the performance of the compound engine—a conventional reciprocating engine and an exhaust gas turbine—at speeds up to 500 m.p.h. and altitudes up to 50,000 ft. Specific fuel consumption and thrust per unit frontal area and per unit weight of power plant were given over the range of operating conditions. An approximate evaluation of the load-range characteristics of aircraft powered with the compound engine was made by plotting the ratio of disposable to gross weight against the ratio of fuel consumption per mile to gross weight. This graph was utilized to illustrate the maximum range obtainable at various combinations of flight speed and altitude.

J. C. Sanders, Chief, Engine Performance Branch, Engine Performances and Materials Research Division, discussed the turbine propeller engine. The effects of variations in pressure ratio, temperature ratio, component efficiencies, altitude, and flight speed and the division of the net cycle power between propeller and jet on fuel consumption and power were presented. Conditions producing the lowest specific fuel consumption and the effects of propeller efficiency on the performance of turbopropeller engines at high speeds were examined. Weights and frontal areas of existing turbine-propeller engines were used to formulate a comparison of this type of engine with other propulsive systems, and it was shown how efficiency of such power plants can be sharply increased by reducing frontal area from today's standards. Mr. Sanders then discussed the possibility for reducing the weight and frontal area.

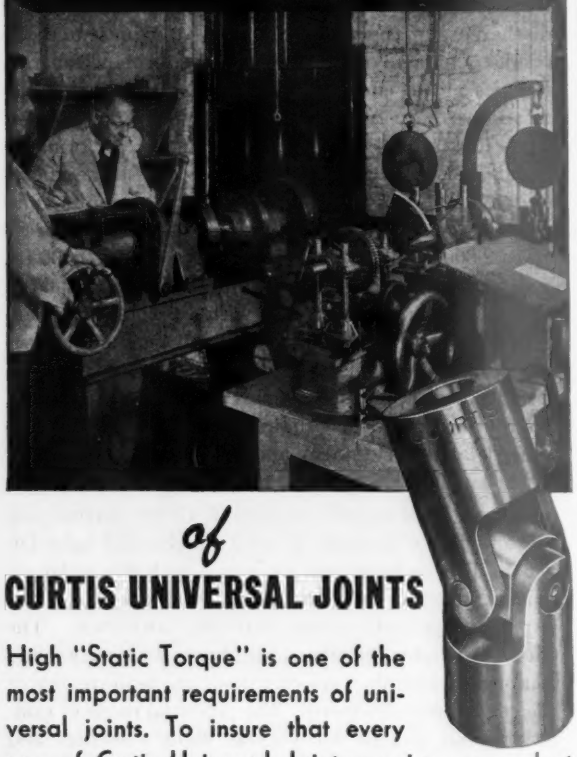
Newell D. Sanders, Chief, Experimental Analysis Panel, Wind Tunnel and Flight Division, discussed some of the fundamental principles of the turbojet engine and gave rough estimates of the performance possibilities of airplanes powered by turbojets up to speeds of 1,500 m.p.h. The fundamental principles were considered from the point of view of propulsive efficiency, thermodynamic cycle efficiency, and the effects of the limitation of combustion temperatures upon performance. At supersonic speeds and altitudes above 30,000 ft., the range increased with speed up to the highest speed investigated.

Bruce T. Lundin, Head, Jet-Propulsion Research Section, Thermodynamics Branch, Fuels and Thermodynamics Research Division, described the turbo-ram-jet engine—a conventional turbojet engine with reheating of the gas to a high temperature between the turbine discharge and the exhaust nozzle—and presented the results of an analytical study of its performance characteristics. The effects of the principal parameters determining the performance of this type of power plant were illustrated and curves of engine performance based on both a turbojet engine typical of those in current use and a turbojet engine with an optimum compressor pressure ratio were presented for flight speeds up to 2,000 m.p.h. and altitudes of sea level, 30,000 ft., and 50,000 ft. The load-carrying capacity and flight range of an airplane powered with a turbo-ram-jet engine were also presented for both subsonic and supersonic flight conditions at various altitudes, and the possible fields of application of this engine were discussed. Mr. Lundin stated that the turbo-ram-jet is in the advanced laboratory stages and gave great promise for future high-speed flight.

George F. Kinghorn, Assistant Head, Engineering Section, Flight Branch, Wind Tunnel and Flight Division, discussed the ram-jet engine with particular attention given to its performance in the 1,800–2,400-m.p.h. range, at 30,000–50,000-ft. altitudes. The effects of flight velocity, altitude, fuel-air ratio, and combustion chamber velocity upon the performance of the engine were discussed. The potential range of ram-jet-powered aircraft for various flight velocities and altitudes and the effect of engine size upon range were presented.

Everett Bernardo, Head, Rocket Section, Combustion Branch, Fuels and Thermodynamics Research Division, presented a paper coauthored with Walter T. Olson on the use of rockets for speeds up to 3,000 m.p.h. at 50,000- and 100,000-ft. altitudes. The primary, rocket engine performance parameters were discussed, and figures illustrating the effect of the primary parameters on the rocket engine performance were shown. In addition, a simplified graph was presented showing the range of a rocket-powered missile as a function of the specific impulse of the propellant, the missile velocity at the end of power, and the ratio of disposable weight to gross weight of the missile. For the purposes of comparison with other types of engines, performance curves of an assumed rocket-powered airplane were presented and discussed. The ratio of the thrust of the engine to the frontal area and the ratio of the propellant consumption to the thrust were shown as functions of flight speed for several altitudes. In addition, a plot was presented showing the weight-carrying capacity of the airplane plotted against the propellant consumption per mile for various speeds and altitudes. Included in this plot was a range scale for estimating the range of the airplane for given values of the parameters.

Static Torque TESTING . . .



of CURTIS UNIVERSAL JOINTS

High "Static Torque" is one of the most important requirements of universal joints. To insure that every user of Curtis Universal Joints receives a product that meets or surpasses his Static Torque requirements, we have developed special testing machines to make this one important test accurately and efficiently.

The small machine in the foreground twists the three small sized joints to destruction by 5 inch lb. steps, the large machine, shown in use, handles larger joints up to 25000 inch lbs.

This testing equipment, designed to meet A.A.F. requirements and specifications, is also used to check every change in material or method of manufacture.

Every Curtis Universal Joint made for aircraft application carries this stamp

Write for technical data and useful Engineering Templates.

Dept. C

CURTIS UNIVERSAL JOINT CO. INC. SPRINGFIELD MASS.

AERODYNAMICISTS

...for development work on Northrop Flying Wings and Guided Missiles

Experienced men needed immediately on government-contract work. We have desirable openings for two types of aerodynamicists with advanced degrees—

(1) Men having five or more years experience; familiar with general aircraft performance and aerodynamic design problems; experienced in stability and control. (2) Men with two years experience, in industry or research laboratory, on theoretical and high-speed aerodynamic problems.

Active aid given in finding suitable housing. Apply by letter or in person to—Engineering Manager.

Northrop Aircraft INC.

HAWTHORNE, CALIFORNIA

Aerodynamics Engineers and Aerodynamicists

WANTED

University trained men who specialized in Aerodynamics and who possess extensive industrial experience in this field are needed by Lockheed to assist in the design of supersonic and other new aircraft

This project under the direction of C. L. Johnson, Chief Research Engineer

Apply by letter or in person to

EMPLOYMENT DEPARTMENT
LOCKHEED AIRCRAFT CORP.

1708 Empire Avenue Burbank, California

Aircraft Engineering

FOUNDED 1929

The Technical and Scientific Aeronautical Monthly

Edited by Lt.-Col. W. Lockwood Marsh
F.I.Ae.S., M.S.A.E., F.R.Ae.S.

Single Copies: 50 cents post free

Subscription: $6.50 per annum, post free

BUNHILL PUBLICATIONS LIMITED
12 Bloomsbury Square London : : W.C.1 England

Services of the Libraries of the Institute of the Aeronautical Sciences

The services of the Libraries are available to all members of the Institute, to Corporate Members, to advertisers in the AERONAUTICAL ENGINEERING REVIEW and AERONAUTICAL ENGINEERING CATALOG, and, under usual library limitations, to the public. Four specialized services are available.

The Paul Kollsman Lending Library

This lending library service makes available, *without charge*, the latest and more important aeronautical books.

Members may request the loan of any aeronautical or technical book they wish to borrow. Through an exchange agreement with the Engineering Societies Library, any book on general engineering may be borrowed from its great collection of over 160,000 volumes.

A photostating service is available at usual library rates.

Applications for membership in the library and further information will be sent on request.

The W. A. M. Burden Reference Library

This reference library contains over 12,000 aeronautical books, magazines, pamphlets, and reports gathered from world-wide sources and is one of the most complete aeronautical libraries in the world. Material from this library is not available for loan but may be used for reference purposes.

The Pacific Aeronautical Library

6715 Hollywood Boulevard
Los Angeles 28, California

Established in cooperation with the aircraft companies the library serves. The leading aircraft companies in or near Los Angeles participate in its support and operation.

This service library for aeronautical research is available to the public for reading privileges. Source material includes aerodynamic and structural research reports, as well as books on drafting, production methods, history, and allied sciences. It furnishes books, periodicals, and pamphlet material to the participating aircraft companies to supplement their engineering libraries.

Technical Information Service

This service has experienced personnel under the supervision of trained aeronautical engineers to compile any information desired. The services range from listing specialized reference books to the preparation of exhaustive bibliographies, digesting of reports, and general surveys of any aeronautical subject. Some of the available services are:

Bibliographies on any aeronautical subject.
Reports on any aeronautical subject.
Digests of aeronautical books, papers, periodicals, and references.
Translations.
Engineering investigations of special aeronautical subjects.
Biographies of individuals engaged in aeronautics.
Photostats of any aeronautical or general engineering material.
Microfilms made on special order.
Photographs made from the Institute's photographic collection.
Drawings and tracings made.

In addition to the services mentioned any commission which comes within the scope of the Service will be accepted. Special arrangements may be made for work requiring several weeks or months.

Translators are available for accurate transcriptions of all foreign language data. Translations are carefully edited by trained engineers.

Reproductions of any material in the collections of the Institute may be ordered at standard photostat rates.

INSTITUTE OF THE AERONAUTICAL SCIENCES, INC.
2 EAST 64th STREET, NEW YORK 21, N.Y.

An Appreciation

TO CORPORATE MEMBERS OF THE INSTITUTE OF THE AERONAUTICAL SCIENCES

Listed below are the leading aeronautical and industrial companies that make possible the publication of the *Journal of the Aeronautical Sciences*.

They enable the Institute to publish scientific and technical papers in the *Journal* and to devote its pages exclusively to editorial material.

Dues from individual members which would normally be used to publish this scientific and engineering monthly are thus released for additional services to the profession and industry.

The *Aeronautical Engineering Review* and the *Aeronautical Engineering Catalog*, together with the *Journal*, provide a comprehensive technical information service for the benefit of the aircraft and related industries.

ACADEMY OF AERONAUTICS, INC.
CASEY JONES SCHOOL OF AERONAUTICS
AERO INSURANCE UNDERWRITERS
AEROJET ENGINEERING CORPORATION
AERONCA AIRCRAFT CORPORATION
AEROPRODUCTS DIVISION, GENERAL MOTORS CORPORATION
AEROQUIP CORPORATION
AGAWAM AIRCRAFT PRODUCTS, INC.
AIRBORNE INSTRUMENTS LABORATORY, INC.
AIRCHOX COMPANY DIVISION, JOYCE AVIATION, INC.
AIRCRAFT RADIO CORPORATION
AIRESEARCH MANUFACTURING COMPANY
AIRESEARCH MANUFACTURING COMPANY OF ARIZONA, INC.
ALLIS-CHALMERS MANUFACTURING COMPANY
ALLISON DIVISION, GENERAL MOTORS CORPORATION
ALUMINUM COMPANY OF AMERICA
AMERICAN AIRLINES SYSTEM
AMERICAN OVERSEAS AIRLINES, INC.
AMERICAN BOSCH CORPORATION
AMERICAN PHENOLIC CORPORATION
ASSOCIATED AVIATION UNDERWRITERS
ASSOCIATED FOUNDRIES & MANUFACTURERS, INC.
ATLAS SUPPLY COMPANY
BAKER STEEL & TUBE COMPANY
BEECH AIRCRAFT CORPORATION
BELL AIRCRAFT CORPORATION
BENDIX AVIATION CORPORATION
BENDIX PRODUCTS DIVISION
BENDIX RADIO CORPORATION
ECLIPSE-PIONEER DIVISION
EXPORT DIVISION
FRIEZ INSTRUMENT DIVISION
PACIFIC DIVISION
SCINTILLA MAGNETO COMPANY
THE BG CORPORATION
BOEING AIRCRAFT COMPANY
BREEZE CORPORATIONS, INC.
ESSEX TOOL & DIE COMPANY
FEDERAL LABORATORIES, INC.
CAL-AERO TECHNICAL INSTITUTE, A DIVISION OF GRAND CENTRAL AIRPORT COMPANY
CARRIER CORPORATION
CESSNA AIRCRAFT COMPANY
CHANDLER-EVANS DIVISION, NILES-BEMENT-POND COMPANY
CHASE NATIONAL BANK OF THE CITY OF NEW YORK
THE CLEVELAND GRAPHITE BRONZE COMPANY
THE CLEVELAND PNEUMATIC TOOL COMPANY
AUTOMOTIVE-AIRCRAFT DIVISION
CLIFFORD MANUFACTURING COMPANY
CONSOLIDATED VULTEE AIRCRAFT CORPORATION
NASHVILLE DIVISION
STINSON AIRCRAFT DIVISION
CONTINENTAL MOTORS CORPORATION
COX AND STEVENS AIRCRAFT CORPORATION
CULVER AIRCRAFT CORPORATION
CURTISS-WRIGHT CORPORATION
AIRPLANE DIVISION
DEVELOPMENT DIVISION
PROPELLER DIVISION
WRIGHT AERONAUTICAL CORPORATION
DOAK AIRCRAFT COMPANY, INC.
DOUGLAS AIRCRAFT COMPANY, INC.
EL SEGUNDO PLANT
LONG BEACH PLANT
THE DOW CHEMICAL COMPANY
DZUS FASTENER COMPANY, INC.
EASTERN AIR LINES, INC.
EATON MANUFACTURING COMPANY
THOMAS A. EDISON, INCORPORATED, INSTRUMENT DIVISION
EDO AIRCRAFT CORPORATION
THE ELECTRIC AUTO-LITE COMPANY
ELECTROL INCORPORATED
ENGINEERING AND RESEARCH CORPORATION
ETHYL CORPORATION
FAIRCHILD CAMERA & INSTRUMENT CORPORATION
FAIRCHILD AERIAL SURVEYS, INC.
FAIRCHILD ENGINE AND AIRPLANE CORPORATION
DURAMOLD DIVISION
FAIRCHILD AIRCRAFT DIVISION
RANGER AIRCRAFT ENGINES DIVISION
FEDERAL TELEPHONE AND RADIO CORPORATION
FIRESTONE AIRCRAFT COMPANY
GENERAL AVIATION EQUIPMENT COMPANY, INC.
GENERAL ELECTRIC COMPANY
THE B. F. GOODRICH COMPANY
THE GOODYEAR TIRE & RUBBER COMPANY
GRUMMAN AIRCRAFT ENGINEERING CORPORATION
W. & L. E. GURLEY
THE HILLIARD CORPORATION
THE INTERNATIONAL NICKEL COMPANY
IRVING AIR CHUTE COMPANY, INC.
JACK & HEINTZ, INC.
JOHNS-MANVILLE SALES CORPORATION
KAISER FLEETWINGS, INC.
WALTER KIDDE & COMPANY, INC.
KOLLSMAN INSTRUMENT DIVISION, SQUARE D COMPANY
LAVELLE AIRCRAFT CORPORATION
LEAR INCORPORATED
LINK AVIATION DEVICES, INC.
THE LIQUIDOMETER CORPORATION
LOCKHEED AIRCRAFT CORPORATION
LONGINES-WITTNAUER WATCH COMPANY, INC.
THE GLENN L. MARTIN COMPANY
THE W. L. MAXSON CORPORATION
WARREN McARTHUR CORPORATION
McDONNELL AIRCRAFT CORPORATION
MENASCO MANUFACTURING COMPANY
MICROMATIC HONE CORPORATION
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
MOORE DROP FORGING COMPANY
NATIONAL CITY BANK OF NEW YORK
NATIONAL CREDIT OFFICE, INC.
NORTH AMERICAN AVIATION, INC.
NORTH AMERICAN AVIATION, INC., OF TEXAS
NORTHROP AIRCRAFT, INC.
NORTHWEST AIRLINES, INC.
OWENS-CORNING FIBERGLAS CORPORATION
PAN AMERICAN WORLD AIRWAYS SYSTEM
THE PARKER APPLIANCE COMPANY
PESCO PRODUCTS COMPANY DIVISION, BORG-WARNER CORPORATION
PHILLIPS PETROLEUM COMPANY
PIONEER PARACHUTE COMPANY, INC.
PIPER AIRCRAFT CORPORATION
PURE OIL CO.
RADIOPLANE COMPANY
REPUBLIC AVIATION CORPORATION
A. V. ROE CANADA LIMITED
JOHN A. ROEBLING'S SONS COMPANY
ROHR AIRCRAFT CORPORATION
THE RYAN AERONAUTICAL COMPANY
SCOTT AVIATION CORPORATION
SHELL OIL COMPANY, INC.
SIMMONDS AEROCESSORIES, INC
SKYDYNE, INC.
SOCONY-VACUUM OIL COMPANY
SOLAR AIRCRAFT COMPANY
SPERRY GYROSCOPE COMPANY, INC.
SQUARE D COMPANY
STANDARD OIL COMPANY OF CALIFORNIA
STANDARD OIL COMPANY (INDIANA)
STANDARD OIL COMPANY OF NEW JERSEY
THE TEXAS COMPANY
THOMPSON PRODUCTS, INC.
TINNERMAN PRODUCTS, INC.
TRANS WORLD AIRLINE
UNION CARBIDE AND CARBON CORPORATION
BAKELITE CORPORATION
HAYNES STELLITE COMPANY
LINDE AIR PRODUCTS COMPANY
NATIONAL CARBON COMPANY
UNITED AIR LINES, INC.
UNITED AIRCRAFT CORPORATION
CHANCE VOUGHT AIRCRAFT DIVISION
HAMILTON STANDARD PROPELLERS DIVISION
PRATT & WHITNEY AIRCRAFT DIVISION
PRATT & WHITNEY AIRCRAFT CORPORATION OF MISSOURI
SIKORSKY AIRCRAFT DIVISION
UNITED STATES AVIATION UNDERWRITERS, INC.
UNITED STATES RUBBER COMPANY
DOMINION RUBBER COMPANY, LTD.
VICKERS, INC.
THE WACO AIRCRAFT COMPANY
WARNER AIRCRAFT CORPORATION
THE WEATHERHEAD COMPANY
WESTERN AIR LINES, INC.
WESTINGHOUSE ELECTRIC CORPORATION
WESTON ELECTRICAL INSTRUMENT CORPORATION
WILLYS-OVERLAND MOTORS, INC., AIRCRAFT RESEARCH AND DEVELOPMENT DIVISION
WYMAN-GORDON COMPANY
YOUNG RADIATOR COMPANY

I.A.S. Meeting Preprints

A limited number of copies of preprints of papers presented at meetings of the Institute are available for distribution, at a charge of 25 cents each to members of the Institute, and 75 cents to nonmembers, to cover handling and mailing charges. The following lists the preprints available from the past two national meetings of the Institute. Preprints may be ordered by number.

National Air Transport Meeting—Washington, D.C., October 24, 1946

27. Development of International Standards for Airworthiness of Transport Aircraft—Paul A. Puvrez, Expert, Airworthiness Division, Provisional International Civil Aviation Organization (PICAO). 9 pages; no illus. (Photo-offset.)

28. Air Conditioning of Transport Aircraft for Year Around Comfort in Flight and on the Ground—Bruce E. Del Mar, Mechanical Test Engineer, Santa Monica Engineering Division, Douglas Aircraft Company, Inc. 10 pages; 10 illus. (Photo-offset.)

29. Teleran for Air Navigation and Traffic Control—L. F. Jones, Manager, Research & Development Projects, Radio Corporation of America. 24 pages, bound in covers; 17 illus. (Printed.)

30. Survey of Air Rescue Requirements—Jerome Lederer, Chief Engineer, Aero Insurance Underwriters. 31 pages; 4 illus. (Photo-offset.)

Fifteenth Annual Meeting—New York, N.Y., January 28–30, 1947

31. Critical Speeds of Shafts Under Torque—R. M. Rosenberg, Instructor, School of Aeronautics, Purdue University. 34 pages; 8 illus. (Ditto.)

32. Numerical Methods for the Calculation of Elastic Instability—B. A. Boley, Instructor, Department of Aeronautical Engineering and Applied Mechanics, Polytechnic Institute of Brooklyn. 38 pages; 6 illus. (Mimeographed.)

33. C.A.A. Testing of Helicopters—R. B. Lightfoot, Chief of Flight Research, Sikorsky Aircraft Division, United Aircraft Corporation. 23 pages; 6 illus. (Ditto.)

34. Progress in Dynamic Stability and Control Research—W. F. Milliken, Jr., Flight Research Department, Cornell Aeronautical Laboratory. 89 pages; 19 illus. (Ditto.)

36. A Method for Calculating Airfoil Sections from Specifications on the Pressure Distributions—Glenn L. Peebles, Design Analyst, Douglas Aircraft Company, Inc. 18 pages; 6 illus. (Ozalid.)

40. High-Speed Underwing Fueling—Eric Olsen, Manager, Aviation Division, The Wayne Pump Company. 8 pages; no illus. (Mimeographed.)

41. Transport Problems with Turbine Power Plants—Frank W. Kolk, Supervisor, Design and Performance, American Airlines, Inc. 10 pages; no illus. (Mimeographed.)

42. The Air Forces Development Program (Army Day Luncheon Speech)—Major Gen. Laurence C. Craigie, Chief, Engineering Division, Air Matérial Command, Wright Field. 16 pages; no illus. (Mimeographed.)

43. Problems of Naval Aviation Confronting the Aeronautical Engineer (Navy Day Luncheon Speech)—Rear Adm. L. C. Stevens, U.S.N., Assistant Chief, Bureau of Aeronautics, For Research and Development. 6 pages; no illus. (Mimeographed.)

American Shielding Conduit

"Saves Money and Time for PCA Capital Airlines"

A YEAR OR SO AGO, Capital Airlines—PCA found that the replacement of spark plug leads reached nearly 50% at 750 hours.

The new American Type HTCD Shielding Conduit assemblies were accordingly tried out, and Luther Harris, Vice President in Charge of Engineering and Maintenance, reports as follows:

"Several American Brass assemblies have reached 3000 hours total operating time with no replacement of parts necessary in the field or at overhaul. The sharp change in replacement rate plus the fewer delays due to harness malfunctioning have saved much of both money and time for Capital Airlines."

Equally important are the exceptional shielding properties characteristic of American HTCD conduit — conclusively demonstrated, time and again, by both laboratory and field tests. Consisting of an interlocked, coated stainless steel flexible inner-core, two carefully designed tinned copper wire braids and a water-tight synthetic jacket, this conduit combines desirable electrical properties with *proven* mechanical construction. American HTCD types of conduit are suitable for any ignition shielding application or for use wherever a rugged, long-lived flexible conduit having a high degree of shielding effectiveness is required. Ask for our "Data Book for Electronics Industries."

46351

ANACONDA

American

METAL HOSE

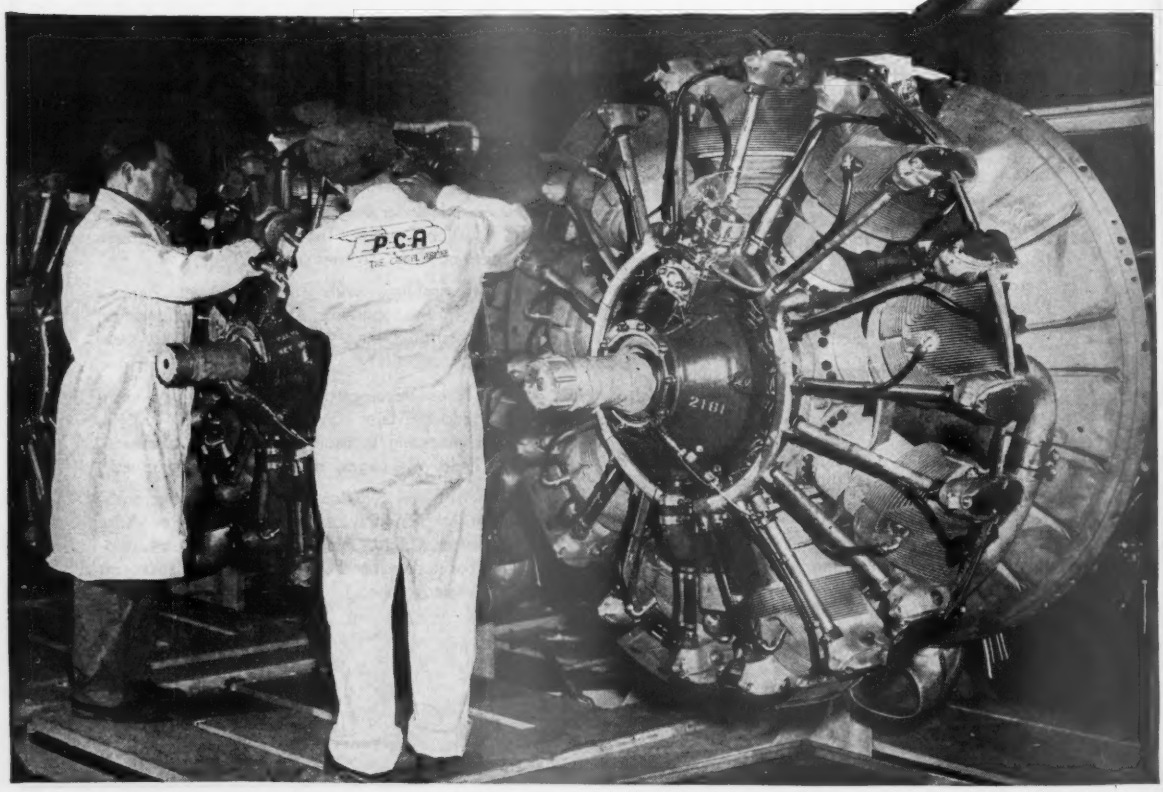
THE AMERICAN BRASS COMPANY

American Metal Hose Branch

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*



Index to Advertisers

A

★Adel Precision Products Corporation, Aircraft Division .. 8
★Aerojet Engineering Corporation, The General Tire & Rubber Company 28
Airesearch Manufacturing Company Division, The Garrett Corporation 56
★Aluminum Company of America 4
American Metal Hose Branch, The American Brass Company 74

B

Beech Aircraft Corporation 36
Bell Telephone Laboratories 58
★Bendix Aviation Corporation, Bendix Products Division. 38
Bunhill Publications Limited 70

C

★Champion Spark Plug Company .....Inside Back Cover
Continental Motors Corporation 30
Curtis Universal Joint Company Inc. 70
Curtiss-Wright Corporation, Wright Aeronautical Corporation Division .....Back Cover

E

★Eaton Manufacturing Company .....Inside Front Cover
Electrical Engineering and Mfg. Corp. 44
★Electrol Incorporated 62

G

G & O Manufacturing Company, The 66
Garrett Corporation, The, Airesearch Manufacturing Company Division 56
General Electric Company, Apparatus Department 16
★General Tire & Rubber Company, The, Aerojet Engineering Corporation 28
★B. F. Goodrich Company, The, Aeronautical Division ... 2

I

International Nickel Company, Inc., The 1, 52, 76

K

★Kollsman Instrument Division, Square D Company 34

L

Lamb Electric Company, The 10
Lockheed Aircraft Corporation 70

M

Macmillan Company, The 68
Glenn L. Martin Company, The 46

N

Northrop Aircraft, Inc. 70

R

★John A. Roebling's Sons Company, Aircord Division ... 40

S

★Sensenich Corporation 66
★Sperry Gyroscope Company, Inc., Division of The Sperry Corporation 64
★Square D Company, Kollsman Instrument Division 34

T

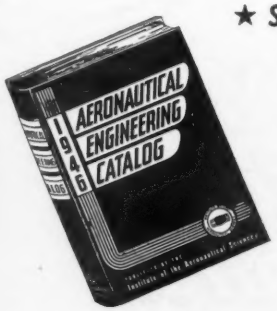
H. I. Thompson Company, The 50

W

★Weston Electrical Instrument Corporation 18
Wm. R. Whittaker Company, Ltd. 60
John Wiley & Sons, Inc. 50, 68
Wright Aeronautical Corporation Division, Curtiss-Wright Corporation .....Back Cover

Y

Young Radiator Company 68



★ *Specifications and further information on the aircraft products of these companies will be found in the*

1946 AERONAUTICAL ENGINEERING CATALOG

The only publication of its kind devoted exclusively to the aircraft industry, this CATALOG serves as a valuable buyers' and reference guide to sources and specifications on aircraft materials, parts, and accessories. It is distributed annually to Chief Engineers, Designers, Production Heads, and Purchasing Departments of all leading Aircraft, Aircraft Engine, Instrument, Accessory, and Aircraft Parts Manufacturers; Air Transport Companies; Army, Navy, and Governmental Agencies; Research Organizations; Engineering Libraries; etc.

Published Annually by

INSTITUTE OF THE AERONAUTICAL SCIENCES

2 East 64th Street New York 21, N.Y.

This Screen and Filter Cloth does the Job for less!

How many times have you wished you could eliminate the shortcomings of ordinary fabric or metal cloth by using filters and screens made of Monel*, Nickel, or Inconel*.

Maybe you've thought they were too expensive to use in your equipment.

Far from it!

In many weaves, this cloth is *cheaper* than less durable metal. The low initial cost and longer service life actually can save you money.

Speak to your equipment manufacturer. Tell him you want the extra protection of the "task metals" in your filters and screens.

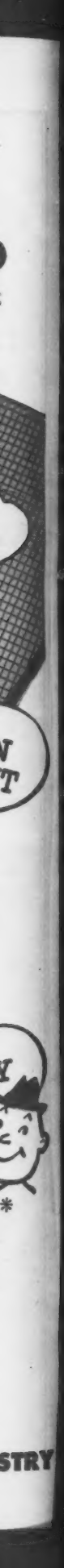
All weaves and meshes are available from regular wire weavers.

*Reg. U. S. Pat. Off.

Send for our booklet: "Established Weavers of Monel, Nickel and Inconel Wire and Filter Cloth."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

INCO TRADE MARK

Monel* **Nickel** **Inconel***

"TASK METALS" FOR INDUSTRY